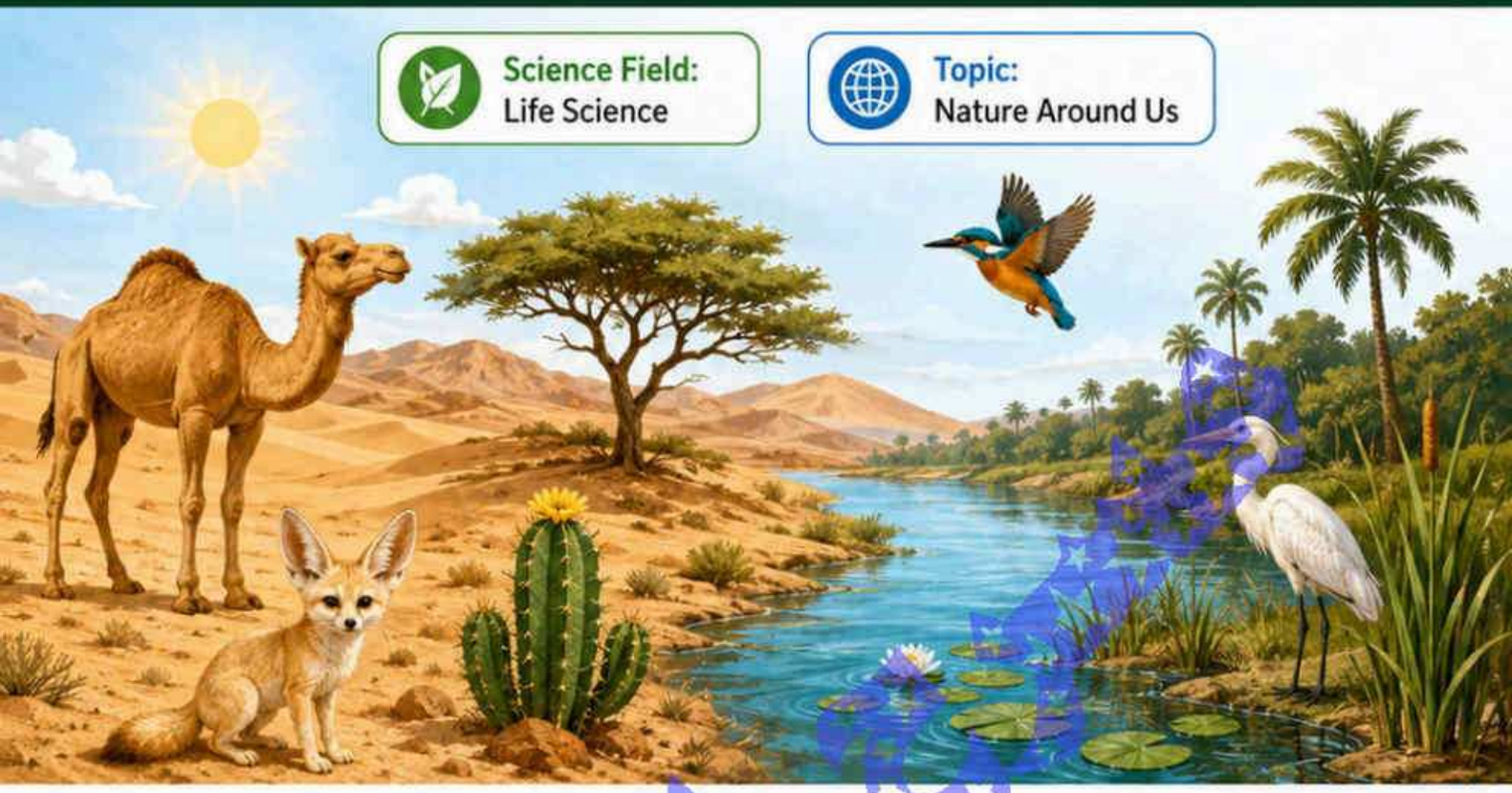
Science Theater

Nature Around Us

Chapter 1 | Chapter Map

Science Field: Life Science

Topic: Nature Around Us



Big Questions

1. How do we know that something is a living organism?
2. How can living organisms survive in a very hot habitat?

What You Will Learn

1. Search for Living Organisms
2. How Do We Observe?
3. Colours and Shapes of Living Organisms
4. Different Places, Different Living Organisms
5. Desert Living Organisms

Key Vocabulary

- natural habitat
- environment
- magnifying lens
- classification
- adaptation

Chapter Focus

- Recognise the basic characteristics of living organisms.
- Observe living organisms carefully.
- Record observations clearly.
- Group living organisms by similar features.
- Explore habitats and simple adaptations.

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What Makes Something a Living Organism?

Chapter 1 | Search for Living Organisms

Science Field: Life Science

Topic: Living Organisms

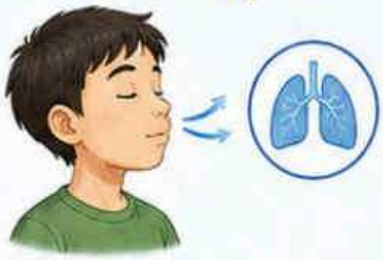
Think Together

What characteristics make living organisms different from non-living things?

Key Concept

Living organisms are things that breathe, feed, and grow.

Breathing



Living things take in air (oxygen) and let out air (carbon dioxide).

Feeding

Living things need food and energy to stay alive and be active.

Growing

Living things increase in size and develop over time.

Examples of Living Organisms

Animals

lion

rabbit

bird

fish

Plants

tree

flower

cactus

grass

Not Living

Rocks, water, and air are not living organisms because they do not breathe, feed, or grow.

rock

water

air

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Where Do Living Organisms Live?

Chapter 1 | Habitats

Science Field: Life Science

Topic: Natural Habitat

Think Together

Where can we find living organisms around us?

Natural Habitat

A natural habitat is the place where a living organism lives, where water and food are available.

Examples of Places

Near grass or trees

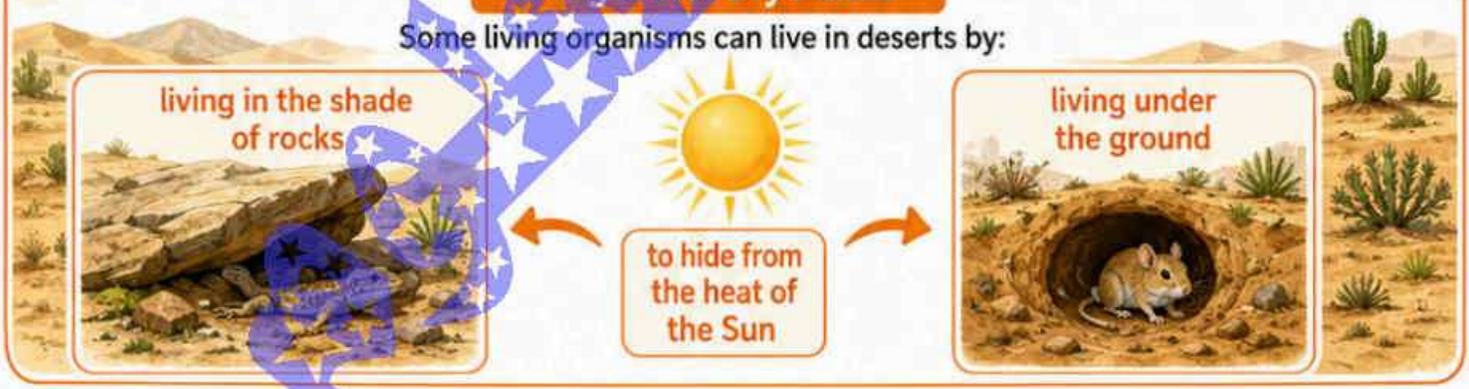
Food is available and hiding is easier.

Under trees or in the shade of rocks

These places are cooler and may be moist.

Living in Hot Dry Places

Some living organisms can live in deserts by:



Find Where They Live

Match each living organism with the place where it lives.

- near flowers

- near tree roots

- between rock cracks

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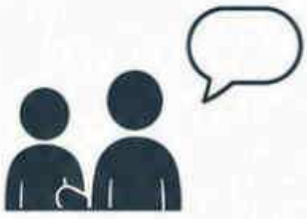
Observe Like a Scientist

Chapter 1 | How Do We Observe?

Science Field: Life Science

Topic: Observing Living Organisms

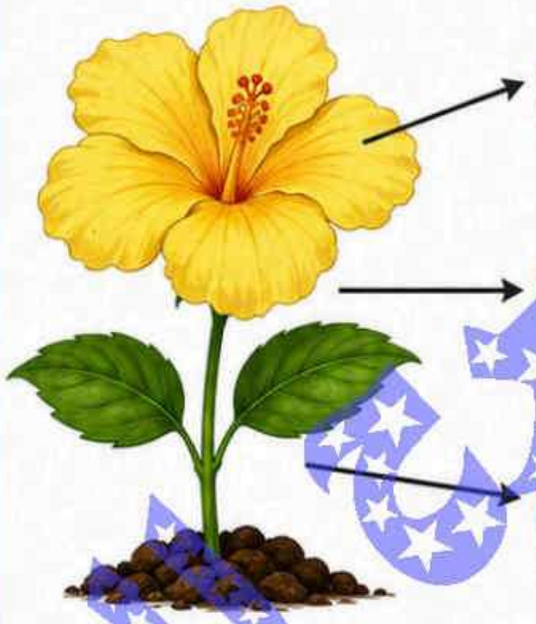
Think Together



What should you look at when you observe a living organism closely?

.....

Observe These Features



shape
What shape are the parts of the organism?

colour
What colours can you see?

size
How big or small is it?

Magnifying Lens

A magnifying lens helps us see the small details of living organisms clearly.

How to Use a Magnifying Lens

1. Hold the lens close to your eye.

2. If the object can be moved, move the object forwards and backwards until the image is clear.
Example: a leaf.

3. If the object cannot be moved, move yourself and the lens forwards and backwards until the image is clear.
Example: a tree trunk.

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Recording Observations

Chapter 1 | Observation Record Card

Science Field: Life Science

Topic: Recording What We Observe

Prepare an Observation Record Card

1. Write the topic first.
2. Write the date and your name.
3. Record what you found using a neat drawing and descriptive sentences.
4. Write what you learned, or what made you curious.

Drawing

Draw clear thin lines and do not shade the drawing.

Descriptive Sentences

Use sentences to describe the place, shape, colour, and size of the living organism.

Safety

- Do not look at the Sun using a magnifying lens.
- Handle living organisms safely and carefully.

Example: Observing a Tree Leaf

length	about 2 cm
colour	green
shape	oval with a serrated edge
place	on a tree in the school garden

Describe What You Observed

- The tree leaf is green and has a serrated edge.
- It is oval in shape and feels smooth.
- It is found on a tree in the school garden.

Try It Yourself

Observe a dung beetle. Look at it first with the naked eye, then with a magnifying lens, and record its length, colour, shape, and place.

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Grouping Living Organisms

Chapter 1 | Colours and Shapes of Living Organisms

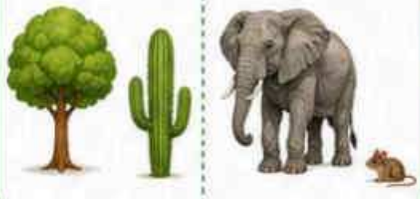
Science Field: Life Science

Topic: Classification

Think Together

How can we put living organisms into groups?

Look for Differences



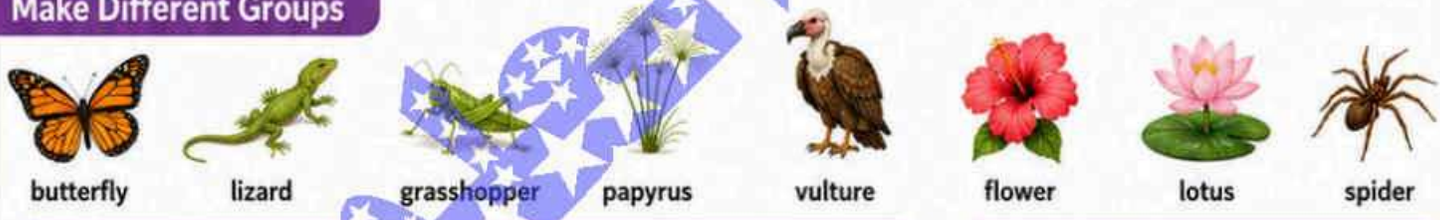
Look for Similarities

Classification

Classification means grouping living organisms that have similar features and putting them into groups.

Grouping by Legs

Make Different Groups



1 By type
Group as: plants / animals

Plants	Animals

2 Plants by colour
Group as: coloured / green

Coloured	Green

3 Animals by size
Group as: larger than a sparrow / smaller than a sparrow

Larger than a sparrow	Smaller than a sparrow

Review

Sort by place of living: water / land

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Different Habitats, Different Living Organisms

Science Field: Life Science

Topic: Habitat Comparison

Think Together

What is the difference between the living organisms on the banks of the Nile River and those in the desert?

A habitat is the place where a living organism lives. → Environmental conditions are different in each habitat. → Therefore, the living organisms that can live there are different.

Comparing Two Habitats

On the banks of the Nile River

Environmental Conditions

- abundant water
- moist soil

Animals

frog

bee

duck

Plants

lotus

clover

orange

Desert

Environmental Conditions

- very little water
- dry soil

Animals

lizard

jerboa

fennec fox

Plants

acacia

colocynth

Conclusion

Living organisms need suitable adaptations so that they can live in their habitats.

Why?

A frog cannot live in the desert because it does not have adaptations that help it survive in the dry desert where water is scarce.

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Adaptations Help Living Organisms Survive

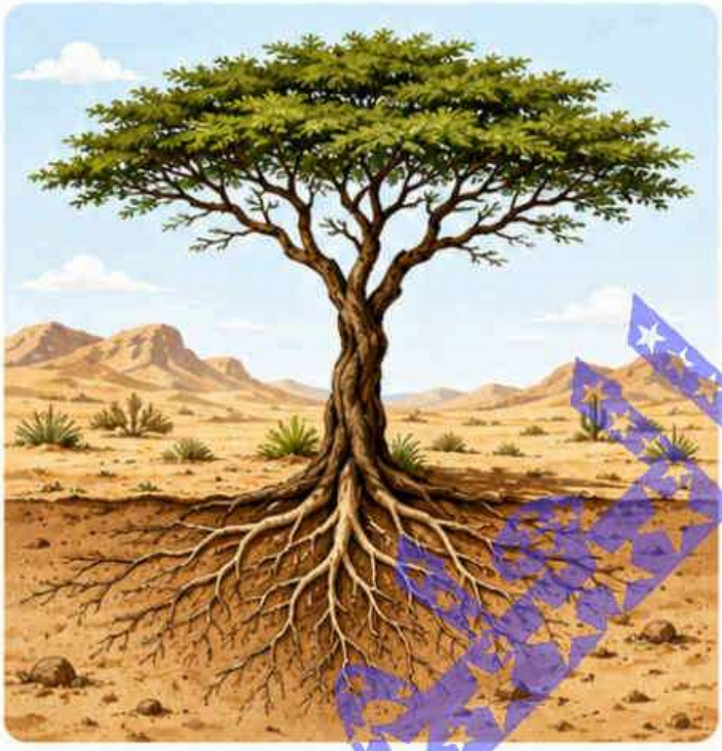
Chapter 1 | Adaptation

Science Field: Life Science

Topic: Adaptation

Adaptation helps living organisms live and survive in their environment.

Example: Acacia Tree



Habitat: desert

Environmental conditions: dry, with little water

Adaptations: small leaves that reduce water loss

Adaptations: deep roots that grow underground to reach water

What Is Adaptation?

Adaptation is a change in a living organism's body parts or behaviour that helps it stay alive in a place.

Think About Habitats

Tick the correct example for each habitat.

Desert → dry → acacia ☐

Nile riverbank → wet → lotus ☐

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Amazing Desert Adaptations

Chapter 1 | Desert Living Organisms

Science Field: Life Science

Topic: Desert Adaptations

Think Together

How do living organisms survive in the hot desert where water is scarce?

Fennec Fox

1. Large ears help cool the body by releasing extra heat.
2. Thick fur on the soles of the feet protects them from hot sand.

Jerboa

1. Long hind legs help it jump quickly, so it touches the hot sand for less time.
2. It gets most of the water it needs from its food.

Clever Ways to Live in the Desert

- Many animals are active at night when the temperature becomes lower.
- During the day, they hide in cool burrows under the ground.

Which One Lives in the Desert?

Write one adaptation for the correct desert organism.

	squirrel	OR		jerboa	✓
	red fox	OR		fennec fox	✓
	lotus plant	OR		acacia tree	✓

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Living Organisms and Their Habitats

Chapter 1 | Review and Enrichment

Science Field: Life Science

Topic: Chapter Review

Chapter Review

Living Organisms
They are all around us and have life.

Natural Habitat
The natural place where organisms live and grow.

Observation
We use our senses and tools to learn about living things.

Classification
We group organisms by their similar features.

Adaptation
Organisms have special traits that help them survive.

Dung Beetle: The Cleaner of the Desert

- Ancient Egyptians cared about this insect and linked it with the Sun.
- It collects animal dung.
- It rolls dung into balls.
- It buries the balls in the soil.

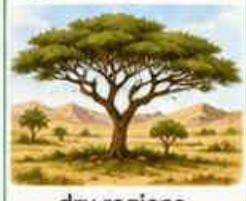
Why Is It Important?

- It helps clean the environment.
- It improves soil fertility because buried dung adds nutrients for plant growth.
- It helps reduce the spread of disease.

Amazing Fact

Studies showed that the dung beetle uses the stars to find its direction, like a natural compass.

Examples of Living Organisms and Their Natural Habitats

1 Date palm	2 Lotus flower	3 Colocynth	4 Papyrus	5 Acacia tree	6 Egyptian clover
					
deserts, oases, and places near the Nile	wet lands and swamps on Nile riverbanks	dry desert habitat	swamps and riverbanks in the Nile Delta	dry regions, deserts, and around oases	cultivated land in the Nile Delta and Upper Egypt
7 Hoopoe	8 Sand cat	9 Cattle egret	10 Monarch butterfly	11 Dung beetle	12 Cobra
gardens and farmland	deserts east of the Nile	Nile banks, farms, and green areas	Nile riverbanks, gardens, and city parks	deserts, grassy lands, and farmland	dry semi-desert places, grasslands, and open areas

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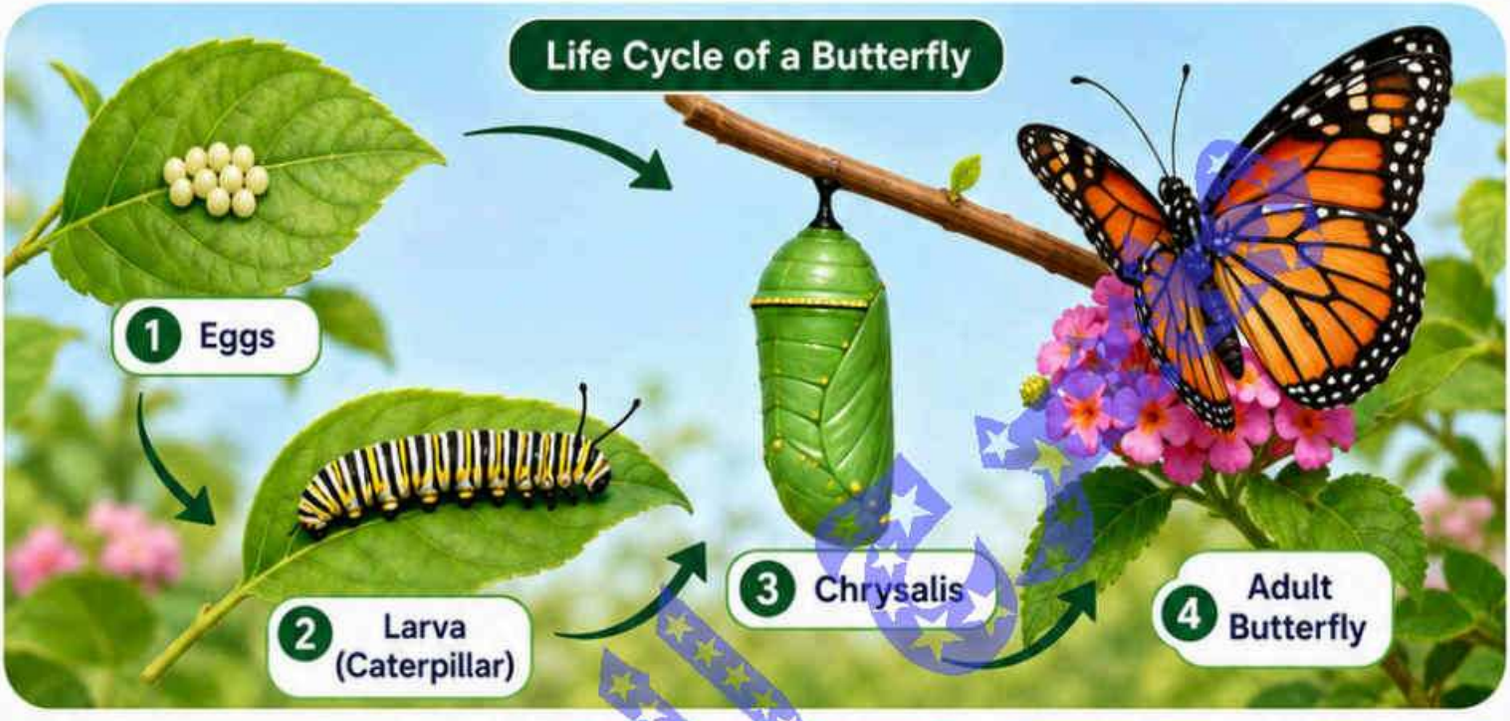
How Do Insects Grow?

Chapter 2 | Chapter Map

Science Field
Life Science

Topic
Insect Growth



WHAT YOU WILL LEARN

1. Eggs and Larvae
2. Chrysalis and Adult Insects
3. Body Structure of Adult Insects

THINK TOGETHER

BIG QUESTION

How do insects grow and change during their life cycle?

KEY VOCABULARY

- egg
- larva
- chrysalis
- adult butterfly
- antennae
- insects

IN THIS CHAPTER

- follow the stages of butterfly growth
- observe eggs and larvae on leaves
- learn how a chrysalis changes
- identify the main parts of an adult insect

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From Egg to Larva

Chapter 2 | Eggs and Larvae

Science Field
Life Science

Topic
Early Stages of Butterfly Growth

THINK TOGETHER

How do insects begin life, and what does the butterfly do on plant leaves?

LIFE CYCLE SEQUENCE

1 EGG

- Most insects begin life as eggs.
- Eggs differ in place, colour, and shape from one insect to another.
- Many insects lay eggs on the lower surface of plant leaves.
- The butterfly chooses the plant that will be suitable food for its young after hatching.
- The egg hatches to produce a larva.

2 LARVA

- A larva is the small insect that comes out of the egg.
- The newly hatched larva eats large amounts of food and grows quickly.
- As it grows, it sheds its old skin in a process called moulting.
- The larva moults several times until it becomes bigger.

Moulting: the process in which the larva sheds its old skin.

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How Does a Larva Grow?

Chapter 2 | Observe the Larva

Science Field
Life Science

Topic
Larval Observation

ENQUIRE

Where do butterflies lay their eggs, and how can we observe a larva closely?

?

WHAT DO WE NOTICE?

- butterfly eggs are found on the lower surface of leaves
- leaves with larvae may have holes caused by feeding
- old skin may be found on leaves beside the holes

OBSERVE BY YOURSELF

1 Look at the lower surface of plant leaves.

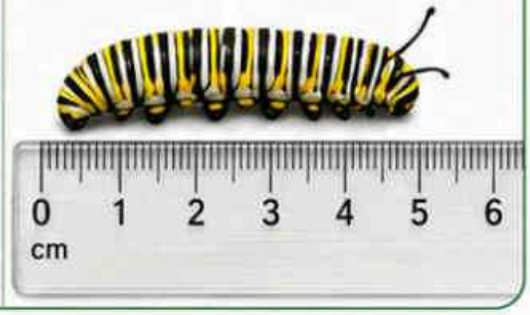
Butterflies lay eggs on the lower surface of plant leaves because these leaves become food for their young.

2 Record the larva's shape and where it is found.

Observe the larva's colour and where it is found. Look for signs of feeding, such as holes in plant leaves.

3 Measure its length.

Use a ruler to measure the length of the larva and record your measurements as it grows.



LARVA GROWTH: REPEATED MOULTING

Young larva (small)
Grows and feeds
Moults (sheds its old skin)
Grows bigger after moulting
Moults again as it grows
Larva continues to grow bigger

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Science Theater

The Chrysalis Stage

4/8

Chapter 2 | Chrysalis and Adult Insects

Science Field
Life Science

Topic
Chrysalis

THINK TOGETHER

BIG QUESTION

How does the butterfly grow from a larva?

STAGES SO FAR

Chrysalis

- After the larva grows, it begins to turn into a chrysalis.
- The chrysalis looks as if it is completely still.
- But important changes take place inside it.
- Inside the chrysalis, the larva changes into an adult insect.

Chrysalis: a quiet stage in which important changes happen and the larva changes into an adult insect.

OBSERVE BY YOURSELF

1 Watch where the larva goes to change into a chrysalis.

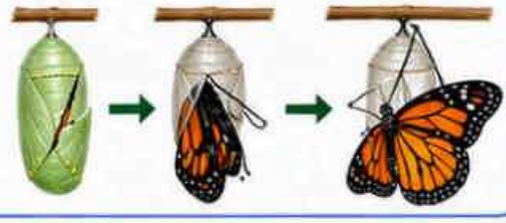
When the larva stops feeding, watch the place it goes to so that it can change into a chrysalis.

2 Look closely at the chrysalis.

Draw the chrysalis and record its shape and colour.

3 Watch the change into an adult butterfly.

When the adult butterfly comes out, the outer covering splits open. After a short time, the wings stretch and spread out after being folded at first.



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Becoming an Adult Butterfly

5/8

Chapter 2 | Adult Butterfly

Science Field
Life Science

Topic
From Chrysalis to Adult

KEY CONCEPT

The adult insect is the fully grown form of the insect.

From Chrysalis to Adult Butterfly

1. the outer covering splits open
2. the butterfly comes out of the chrysalis
3. after a short time, the wings stretch and spread out
4. the wings were folded at first

ADULT BUTTERFLY

- The adult insect is the fully grown form.
- The adult butterfly is able to lay eggs.
- This begins a new life cycle.

COMPLETE THE IDEA

1. The quiet stage is called the chrysalis.
2. The stage in which the insect lays eggs to begin a new life cycle is the adult stage.

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Body Structure of Adult Insects

6/8

Chapter 2 | Structure of Adult Insects

Science Field
Life Science

Topic
Adult Insect Body Parts

THINK TOGETHER

What does the body of an adult butterfly look like?

ADULT INSECTS

Insects are animals whose bodies have 3 main parts: **head, thorax, and abdomen.**

EXAMPLES OF ADULT INSECTS

Butterfly

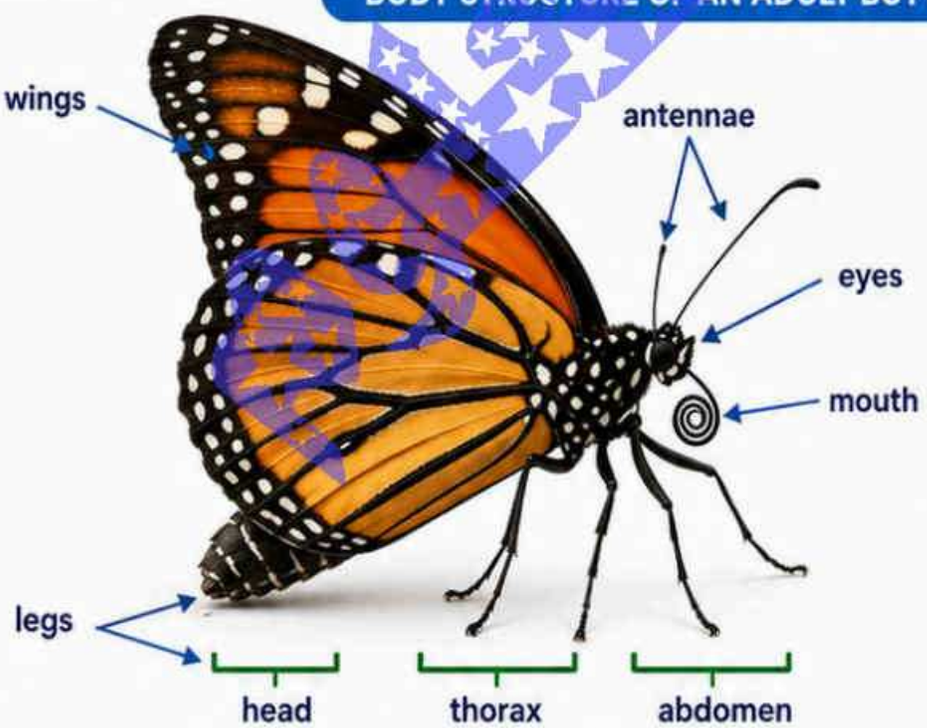
Dung Beetle

Ant

Dragonfly

Grasshopper

BODY STRUCTURE OF AN ADULT BUTTERFLY



- There is one pair of antennae on the head.
- The butterfly's body has 3 parts: head, thorax, and abdomen.
- It has 4 wings and 6 legs.
- The wings and legs are attached to the thorax.

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What Makes an Animal an Insect?

Chapter 2 | Apply by Yourself

Science Field
Life Science

Topic
Insects and Non-Insects

THINK AND OBSERVE

Look at the grasshopper, butterfly, and ant. How are their bodies alike?

1 Find the Similarities

Grasshopper

Butterfly

Ant

- Identify the body parts.
- The body parts are: **head, thorax, abdomen.**
- Examine where the legs are attached using a magnifying lens.
- The legs are attached to the **thorax.**

2 Compare It with Another Animal

Butterfly (an insect)

Spider (not an insect)

3 Conclusion

Is a spider an insect? Why or why not?

No. A spider is not an insect because insects have bodies divided into **three parts** and they have **six legs** attached to the **thorax.**

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Butterfly Life Cycle – Observe, Grow & Review

8/8

Chapter 2 | Review and Activity

Science Field
Life Science

Topic
Butterfly Life Cycle Review

1 OBSERVATION CARDS

1 Egg

- about 1 mm
- yellowish
- oval
- on the lower surface of plant leaves

2 Larva

- about 3 cm
- greenish-black and yellow
- long and segmented
- on tree leaves

3 Chrysalis

- about 3 cm
- green
- hanging on a plant stem

4 Adult Butterfly

- about 7 cm across
- orange and black
- six legs and four wings
- found in a garden

2 REAR BUTTERFLIES FROM EGGS

1

Prepare a transparent container with air holes and place inside it the leaves that have butterfly eggs.

2

Daily care: clean the waste regularly and provide always-fresh leaves from the plants the larvae feed on.

3

When the larvae prepare to change into a chrysalis, watch them quietly without disturbance.

4

When the adult butterfly comes out, wait until its wings become strong and spread out, then release it outside.

3 LIFE CYCLE SUMMARY

Egg → Larva → Chrysalis → Adult Butterfly

4 CHAPTER REVIEW

insects may begin life as eggs

the larva feeds and grows quickly

inside the chrysalis, the larva changes into an adult insect

adult insects are the fully grown stage

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How Do Plants Grow?

Chapter 3 | Overview

CHAPTER ENQUIRY

How do plants grow?

SCIENCE FIELD

Life Science

TOPIC

Chapter Overview

STORY STARTER

Salma ate an apple in the garden and dropped some seeds into the soil. After a few days, she noticed that the seeds had started to germinate and a small plant had appeared.

THINK AND EXPLORE

1. How did the tiny apple seed become a plant?
2. What are the parts of this plant?
3. Is it exactly like the other plants in the garden?

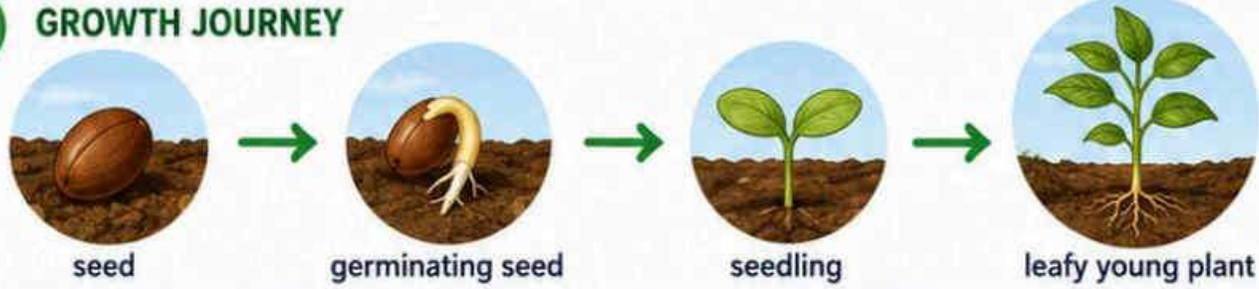
CHAPTER SECTIONS

- 3-1 Planting Seeds
- 3-2 After Germination
- 3-3 Flowers and Fruits
- 3-4 Parts of a Plant

KEY VOCABULARY

- seeds
- seed leaves
- true leaves
- roots
- stem
- leaves
- buds

GROWTH JOURNEY



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Seeds: The Beginning of Plant Life

Chapter 3 | Planting Seeds

KEY CONCEPT

Most plants begin life as seeds.

SCIENCE FIELD
Life Science

TOPIC
Seeds and Seed Types

SUPPORTING STATEMENT

Seeds differ in shape, colour, and size depending on the plant type.

EXAMPLES OF SEEDS

broad bean

sunflower

chickpea

bean

SUCCESSFUL PLANTING

For seeds to grow well, we must choose the correct planting time and use the correct planting method.

The best planting time depends on the type of plant.

REMEMBER

Different plants produce different kinds of seeds.

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How to Plant a Seed

Chapter 3 | Planting Seeds

Planting success depends on the right time and the right method.

SCIENCE FIELD
Life Science

TOPIC
Planting Method

BEST PLANTING TIME

Broad bean

Best planted in October–November.

Sunflower

Best planted in March–April.

PLANTING METHOD

1. Make a hole in the soil about 1 cm deep using your finger.
2. Put the seed inside the hole and cover it gently with soil.
3. Then water it with a suitable amount of water.

After planting and watering, wait and observe what happens.

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From Seed to Seedling

Chapter 3 | After Germination

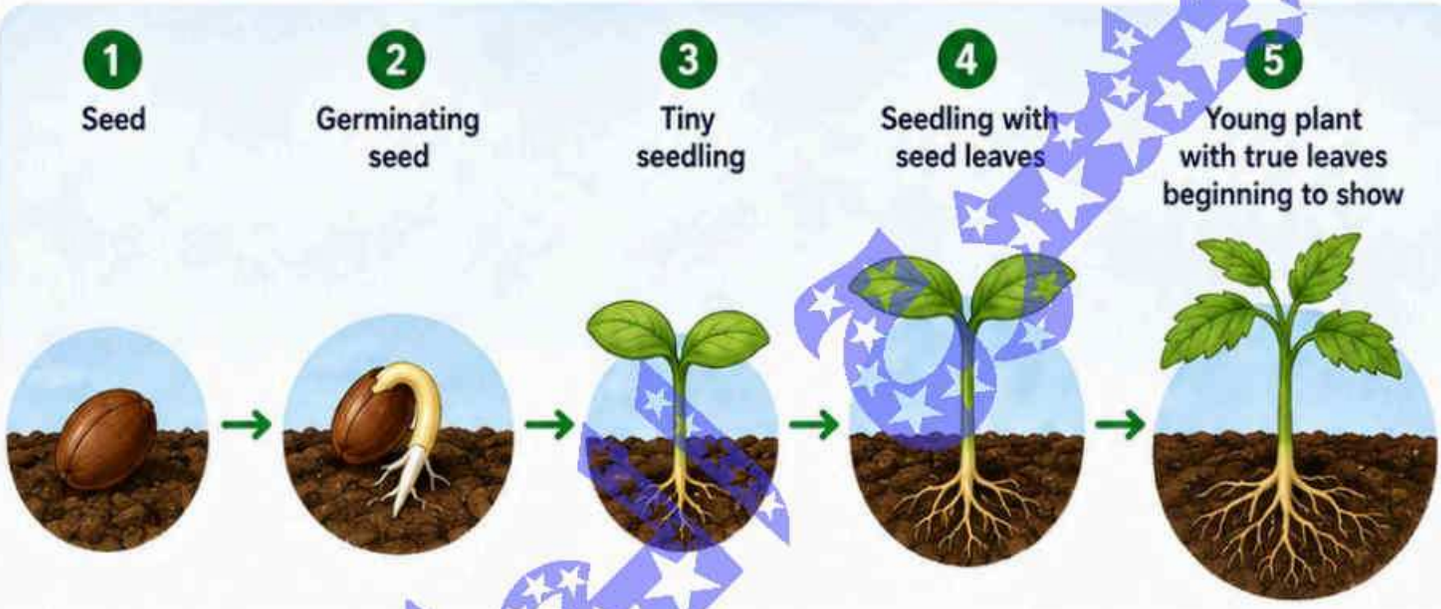
KEY EXPLANATION

After seeds are planted and some time passes, a tiny seedling appears.

SCIENCE FIELD
Life Science

TOPIC
Early Plant Growth

In many plants, seed leaves appear first, then true leaves appear later.



OBSERVE FOR YOURSELF

1. Use a magnifying glass to look closely at seeds such as sunflower, broad bean, chickpea, and lentil.
2. Record your observations.
3. Plant the seeds you chose.
4. Notice how the resulting plants differ.

TAKEAWAY

A plant begins as a seed, then grows into a small seedling.

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Seed Leaves and True Leaves

Chapter 3 | After Germination

SEED LEAVES

These are the first leaves of the plant. They are also called cotyledons.

TRUE LEAVES

After the seed leaves appear, other leaves grow. These are called true leaves.

Some plants, such as sunflower and balsam, have two seed leaves.

True leaves differ in shape and colour from seed leaves, and their number increases gradually as the plant grows.

Feature	Seed Leaves (Cotyledons)	True Leaves
Colour	Yellowish green	Darker green
Shape	Small and oval	Jagged edges
Texture	Smooth and thin	Smooth and thicker

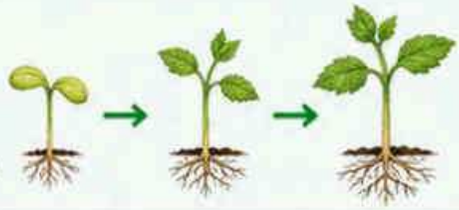
MEASURING PLANT HEIGHT

Plant height is measured from the surface of the soil to the highest point of the plant.

CONCLUSION

As a plant grows, its height and leaf shape change.

The leaves become larger, more numerous, and greener.



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From Flowers to Fruits

Chapter 3 | Flowers and Fruits

KEY IDEA

When plant growth is completed, the plant forms buds.

SCIENCE FIELD
Life Science

TOPIC
Flower and Fruit Development

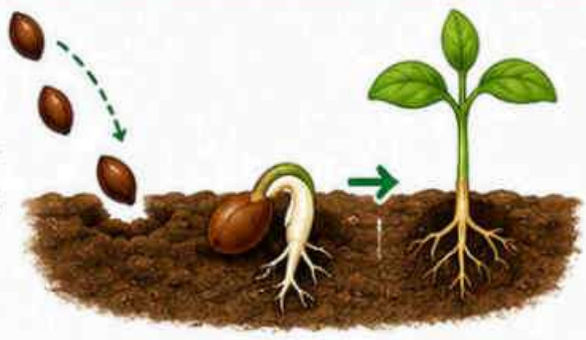
The buds open and become flowers. After that, the flowers become fruits.

After the Flower Stage

1. The petals wither and fall.
2. The lower part of the flower swells and grows gradually to become a fruit.
3. As the fruit ripens, new seeds form inside it.

Inside the Fruit

- When the fruit ripens, seeds can fall from it.
- When the seeds fall on the soil, they germinate again and grow into a new plant.



Flowers prepare the seeds for the next generation.

In this way, plants ensure the continuation of life from one generation to the next.

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Parts of a Plant

Chapter 3 | Parts of a Plant

LET'S DISCOVER!

A plant has three main parts.

SCIENCE FIELD
Life Science

TOPIC
Structure and Function

LEAVES

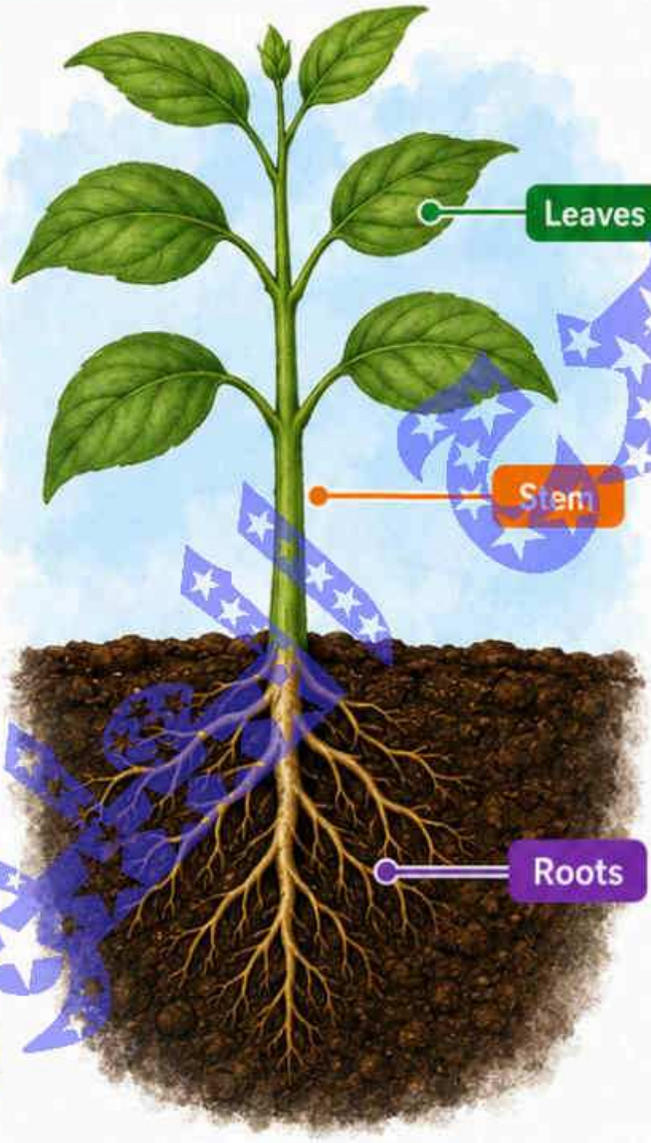
Some leaves are broad and flat, helping them capture as much sunlight as possible.

STEM

It supports the plant and acts like a passage that carries the water absorbed by the roots to the leaves and flowers.

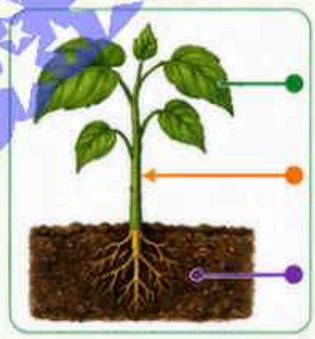
ROOTS

They grow under the soil, anchor the plant firmly, and absorb water from the soil.

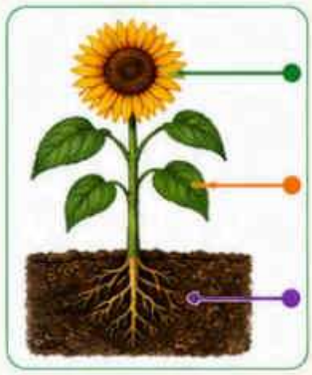


EXAMPLES

Bean plant

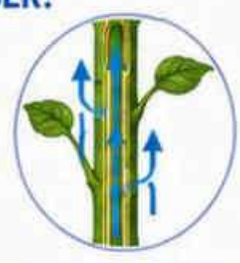


Sunflower plant



All plants have roots, stems, and leaves.

REMEMBER!



The stem works like a passage for water because it carries water from the roots to the leaves and flowers.

Some leaves are broad and flat to capture more sunlight.

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Growth Stages in Different Plants

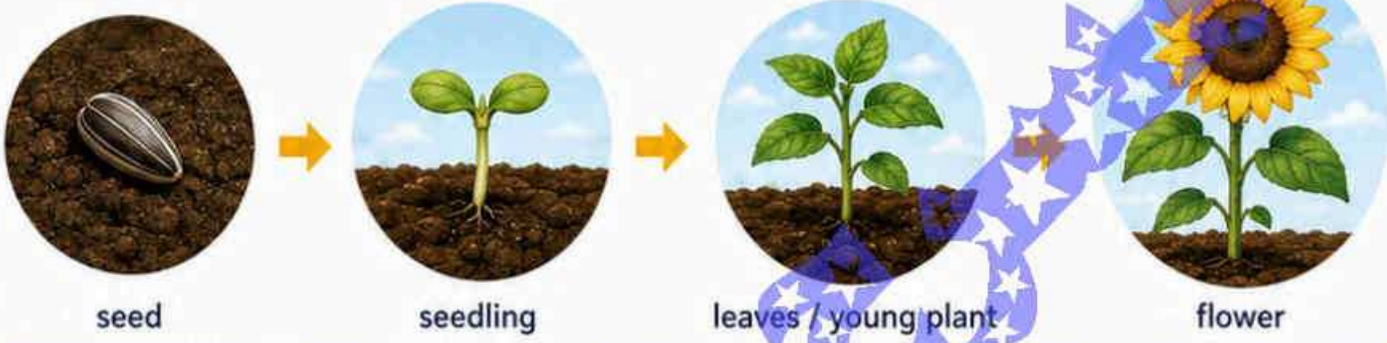
Chapter 3 | Plant Growth Examples

- The examples below show the growth stages of some plants.
- Notice that the shape of seeds, flowers, and fruits differs from one plant to another.

SCIENCE FIELD
Life Science

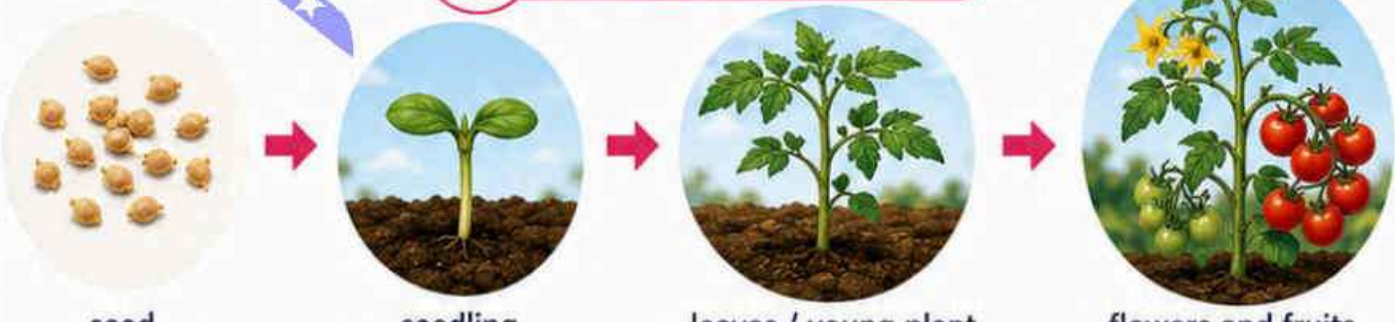
TOPIC
Comparing Plant Growth

SUNFLOWER



ARABIAN JASMINE

CHERRY TOMATO



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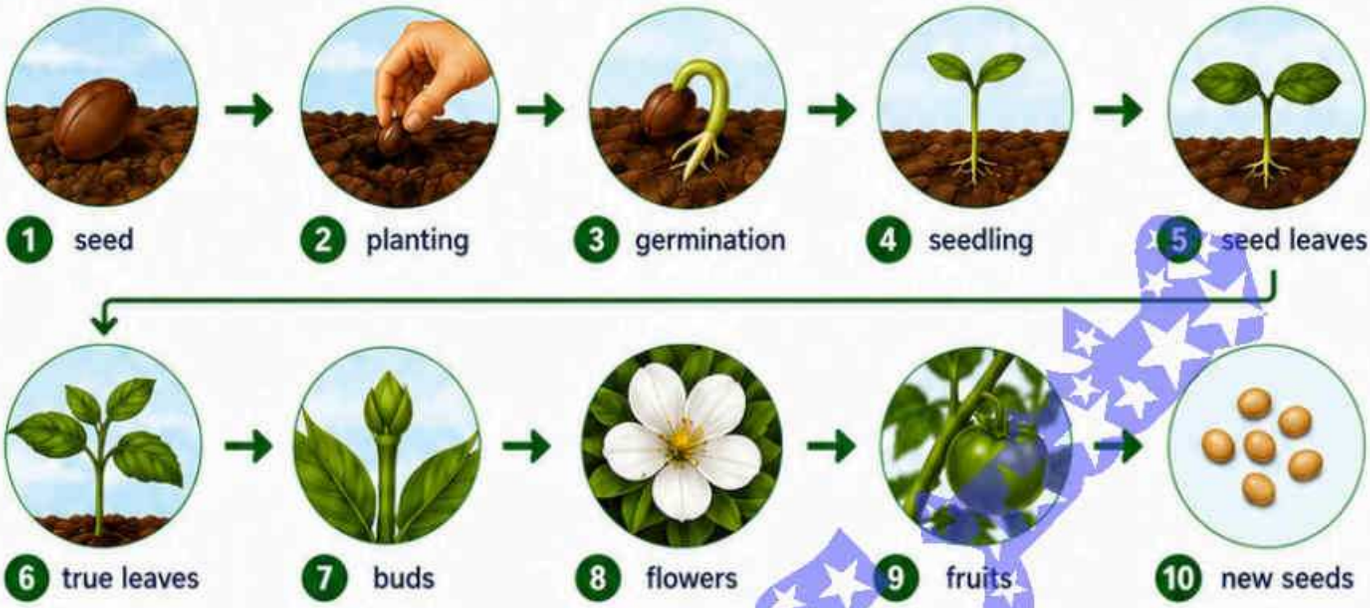
Chapter 3 Review Map

Chapter 3 | Final Review

THE GROWTH JOURNEY

Plants go through a life cycle.
Here is the journey from a seed to new seeds.



PLANTING SEEDS

- Most plants begin life as seeds.
- Seeds differ in shape, colour, and size.
- Correct time and method help seeds grow well.

AFTER GERMINATION

- A tiny seedling appears after some time.
- Seed leaves appear first, then true leaves.
- Plant height increases as the plant grows.

FLOWERS AND FRUITS

- Buds open into flowers.
- The flower changes into a fruit.
- New seeds form inside the fruit.

PARTS OF A PLANT

- Roots anchor the plant and absorb water.
- The stem supports the plant and carries water.
- Leaves help the plant capture sunlight.

DIFFERENT PLANTS, DIFFERENT FEATURES

Different plants may have different seeds, flowers, and fruits.

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Science Theater

Chapter 4: Properties of Light

Physical Science | First Term

Main Enquiry Question:
How does light travel, and how do sunlight and shadows behave?

Science Field	Physical Science
Topic	Chapter Overview

What you will learn

- Light travels in straight lines.
- Light sources.
- Reflection.
- Regular and irregular reflection.
- Changing the direction of light with mirrors.
- Concentrating sunlight with a magnifying lens.
- How shadows form.
- How shadow direction changes.
- How shadow length changes during the day.
- Sunlight, shade, and ground temperature.

Key Vocabulary

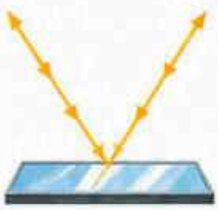
- light
- light source
- reflection
- regular reflection
- irregular reflection
- concentrated light
- shadow

CHAPTER MAP

1. How light travels

- Light travels in straight lines.
- We see objects when light reaches them.

2. Reflection



- Light can bounce off a surface.
- Smooth surfaces give regular reflection.
- Rough surfaces give irregular reflection.

3. Concentrating sunlight

- A magnifying lens gathers sunlight into a small bright spot.
- A smaller spot becomes brighter and hotter.

4. Shadows

- A shadow forms when an object blocks light.
- Shadow direction and length change during the day.

5. Sun and shade

- Sunny ground becomes warmer.
- Shaded ground stays cooler and more moist.

Remember
This chapter links light, reflection, lenses, and shadows through observation and practical activities.

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How Light Travels and Reflects

Think When a room becomes dark, we need light so we can see objects around us.

Science Field	Physical Science
Topic	Light Travel and Reflection

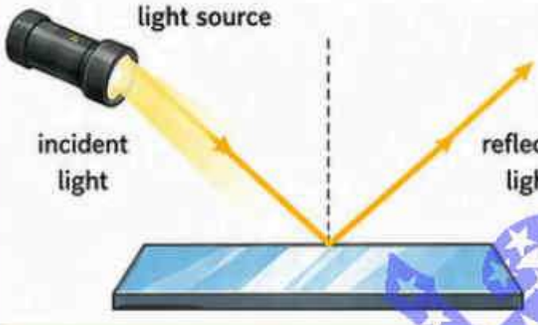
Key Concept Light travels in straight lines unless it meets an object in its path.

Sources of light

Sun | kerosene lamp | electric bulb | candle | torch

Light source: an object that gives out its own light.

What happens when light meets a surface?



When light strikes a surface such as a mirror, it does not stop. It bounces back and changes direction. This is called reflection.

Reflection: the bouncing back of light when it falls on a surface.

Types of reflection

Regular reflection

Light rays bounce back in one orderly direction when they fall on a smooth, shiny surface.

Surface type	smooth and shiny
Examples	mirror, spoon, aluminium foil

Irregular reflection

Light rays scatter in different directions when they fall on a rough surface.

Surface type	rough
Examples	wood, plastic, paper, wall

Why? A clear patch of light can be seen on a wall when a torch is reflected by a mirror because the smooth mirror reflects light in an orderly direction.

Remember The type of surface affects how light is reflected.

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Changing the Direction of Light

Chapter 4 | Mirror Investigation

This investigation explores how a plane mirror can change the direction of light and guide it towards a target.

Science Field	Physical Science
Topic	Light and Mirrors

Question / Prediction

Can we control the direction of light and send it to different places?

Safety First

- Do not direct sunlight into the eyes.
- Do not direct reflected light towards people's faces or classroom windows.

Tools

- plane mirrors
- water spray or mist
- starch/powder for making the light path visible

Procedure

1. Use one mirror to reflect sunlight and direct a spot of light towards a chosen target in a shaded area.
2. Spray a little mist or scatter fine powder in the air along the path between the mirror and the target, and observe the light path.
3. Add a second mirror, then a third mirror, so the reflected light changes direction several times along different paths.

Observations

Case 1: One mirror

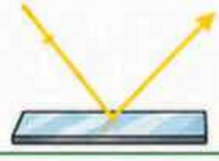
Observation: The reflected light path can be seen clearly in the air and travels in straight line towards the target.

Case 2: Several mirrors

Observation: Each mirror changes the direction of light. Between the mirrors, the light continues to travel in straight lines.

Conclusion

- A mirror changes the direction of light when light falls on it.
- Light changes direction by reflection.
- Even after reflection, light continues to travel in straight lines between one reflection and the next.



Remember Mirrors do not stop light. They redirect it.

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Science Theater

Concentrating Sunlight

Chapter 4 | Magnifying Lens

4/9

Think

On a sunny day, what happens if sunlight passes through a magnifying lens and falls on paper?

Science Field	Physical Science
Topic	Concentrated Light

1. How sunlight is concentrated

1. Sunlight reaches the lens from a wide area.
2. The magnifying lens gathers the sunlight into one small bright spot.
3. When the light is concentrated, the spot becomes brighter and hotter.

We conclude

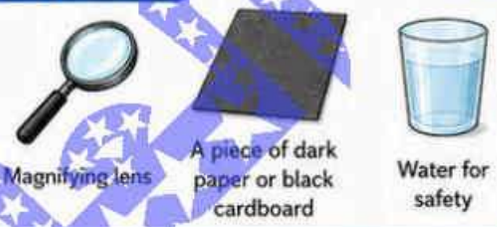
The smaller the concentrated light spot, the brighter and hotter it becomes.

2. Investigation: Heating paper with sunlight

Question / Prediction

Can concentrated sunlight from a magnifying lens produce enough heat to burn paper?

Tools



Magnifying lens | A piece of dark paper or black cardboard | Water for safety

Safety First

- Use black or dark paper because it absorbs sunlight better than white paper.
- Never look directly at the Sun through a magnifying lens.
- Do not focus sunlight onto people or living things.
- Do not keep the bright spot on the same place for a long time unless the investigation requires it and it is done safely.

Procedure

1. Step 1: Place the dark paper in a sunny place and fix it.
2. Step 2: Hold the magnifying lens so a large light spot appears on the paper and wait briefly.
3. Step 3: Move the lens up or down until the smallest possible bright spot is formed.
4. Step 4: Keep the lens steady for a few moments to concentrate the light on that small spot.
5. Step 5: Compare the large spot and the small spot in terms of heat effect.

3. Observations

1. Large light spot — The light is spread over a large area, so the paper does not burn.
2. Small bright spot — The temperature rises and the paper becomes hotter.
3. Continuous concentration — The paper may smoke or burn because the temperature becomes high enough.

4. Conclusion

- Light passing through a magnifying lens gathers at one point as a light spot.
- When the area of the light spot becomes smaller, the concentration of light increases.
- A smaller spot produces a higher temperature, which may burn the paper.

Remember

Concentrating sunlight increases both brightness and heat.

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How Shadows Form

Think
Why does a dark area appear behind an object when sunlight falls on it?

Science Field	Physical Science
Topic	Shadow Formation

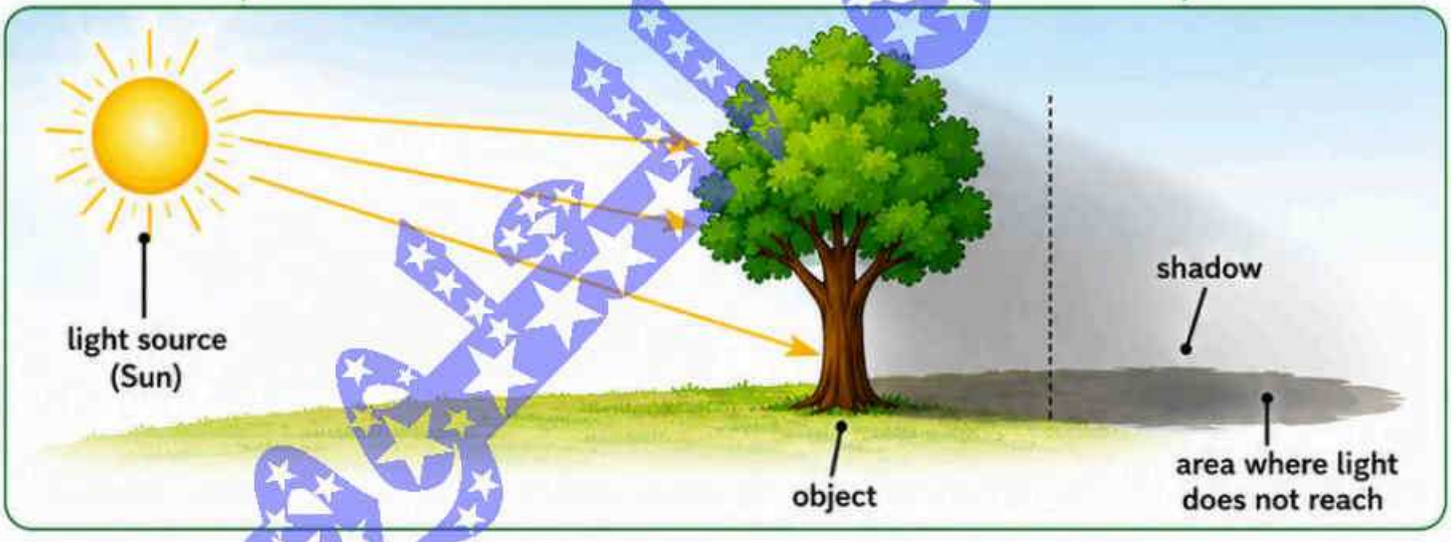
Key Concept Light travels in straight lines. When an object blocks the light, a shadow forms behind it.

How a shadow is formed

1 Light source
Sunlight travels in straight lines from the Sun.

2 Light meets an object
When light strikes an object, the object blocks the light from passing through.

3 Shadow forms
A dark region appears behind the object where light does not reach. This region is the shadow.



Definition
Shadow: a dark region behind an object where light does not reach.

We conclude
The light source, the object, and the shadow lie in one straight line.

Why?
- Why does the region behind the object look dark?
  → Because the object prevents light from reaching that region.
- Why are the light source, object, and shadow in one straight line?
  → Because light travels in straight lines.

Remember
A shadow is formed when light is blocked.

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Why Shadow Direction Changes

Chapter 4 | Sun Position and Shadow

Think

Why does the shadow of the same object point in different directions during the day?

Science Field:	Physical Science
Topic:	Shadow Direction

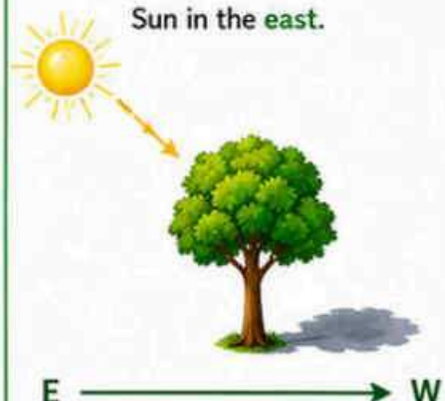
Key Concept

A shadow always forms on the side opposite the light source. When the position of the Sun changes, the direction of the shadow changes too.

Shadow direction at different times of day

Morning

Sun in the east.



Shadow forms towards the west.

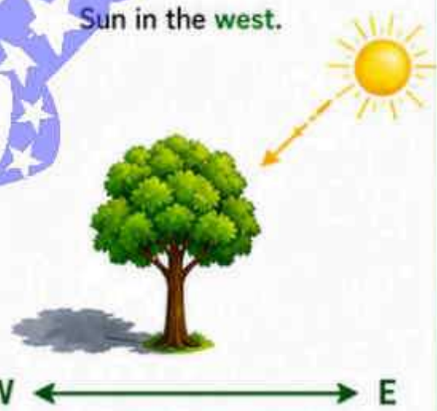
Midday

Sun high in the sky.

Shadow forms beneath the object.

Evening

Sun in the west.



Shadow forms towards the east.

We conclude

Whenever the position of the Sun changes, the direction of the shadow changes.

Try it yourself: Check shadow direction

Tools

- Wooden stick

Procedure

1. Put a wooden stick upright in the ground.
2. Observe the direction of the shadow in the morning.
3. Observe the shadow again at midday.
4. Observe the shadow once more in the evening and compare the directions.

Notice and answer

- Does the shadow stay in the same direction all day?
- What happens to shadow direction when the Sun changes position?
- What is the relationship between the Sun's position and the shadow's direction?

Safety First Do not look directly at the Sun.

Remember

The shadow points away from the light source.

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How Shadow Length Changes

Chapter 4 | Shadow Movement During the Day

Think

Why is a shadow long in the morning, shortest at midday, and long again before sunset?

Science Field:	Physical Science
Topic:	Shadow Length

Key Concept

As the Sun appears to move across the sky, both the direction and the length of the shadow change.

Shadow length at different times of day

Morning

The Sun is low in the sky near sunrise.

The shadow is long and points towards the west.

Midday

The Sun is high in the sky.

The shadow is short and lies beneath the object.

Evening

The Sun is low in the sky near sunset.

The shadow is long and points towards the east.

Real-life application: Sundial

In the past, people used sundials to estimate time by observing the regular movement of shadows during the day.

We conclude

The length and direction of a shadow change with the position of the Sun in the sky.

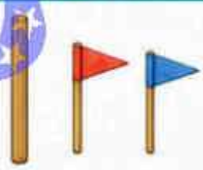
Investigation: Tracking a shadow

Question / Prediction

Does the position and length of a shadow change during the day?

.....

Tools



wooden stick, small flags or markers

Procedure

1. Put a wooden stick in a place that receives sunlight in the early morning.
2. Mark the end of the shadow and write the time beside the mark.
3. Repeat this every hour until the end of the day.
4. Join the marked points to show how the shadow moved during the day.

Observations

- The shadow does not remain fixed. It moves and changes direction during the day.
- The shadow is long in the early morning, becomes shortest at midday, then grows longer again before sunset.

Conclusion

The position and length of the shadow change regularly because the position of the Sun changes in the sky throughout the day.

Remember

A shadow is shortest when the Sun is highest in the sky.

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Sunlight, Shade and Ground Temperature

Chapter 4 | Sun and Shade

8/9

Think

If you touch the ground in a sunny place and then in a shaded place, what do you notice?

Science Field:	Physical Science
Topic:	Ground Temperature

Sunny place and shaded place

Sunny place

- The ground becomes warmer.
- It appears drier.

Shaded place

- The ground is cooler.
- It is often more moist.

Why does this happen?

Path A (Sunny)

Sun's rays reach the ground directly. → The ground absorbs the Sun's rays continuously. → Ground temperature rises. → The ground becomes warmer.

Path B (Shaded)

The Sun's rays do not reach the ground directly. → The ground is not heated as much. → Ground temperature remains lower. → The ground stays cooler and more moist.

★ **The more sunlight reaches the ground, the higher its temperature becomes.**

Investigation: Measuring ground temperature

Question / Prediction

? Is the temperature of the ground different in the Sun and in the shade?

Tools

ordinary thermometer or infrared thermometer

Safety / Conditions

- If using an ordinary thermometer, place the lower part close to the ground and shade it from direct sunlight using your hand or a small object.
- If using an infrared thermometer, use it at a suitable distance without touching the ground.

Procedure

1. Choose one place reached by sunlight and another place in the shade of a tree.
2. Put the thermometer in the first place and record the temperature.
3. Put the thermometer in the second place and record the temperature.
4. Compare the temperatures in the sunny and shaded places.

Observations

Sunny place

High temperature.

Shaded place

Lower temperature.

Conclusion

- In sunny places, the ground absorbs the Sun's rays, so the ground temperature rises.
- In shaded places, an object blocks the Sun's rays, so the ground temperature becomes lower.
- The temperature of the ground is higher in places reached by direct sunlight and lower in shaded places.

Remember Shade reduces the amount of sunlight reaching the ground.

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Light and Shadows – Final Review

Chapter 4 | Review Map

Chapter Summary

In this chapter, we learnt how light travels, reflects, becomes concentrated, forms shadows, and affects ground temperature in sunny and shaded places.

Science Field:	Physical Science
Topic:	Chapter Review

CONCEPT MAP

Properties of Light

1. Light travels

- Light travels in straight lines.
- We see objects when light reaches them.

2. Reflection

- Light bounces back from a surface.
- Smooth shiny surfaces give regular reflection.
- Rough surfaces give irregular reflection.

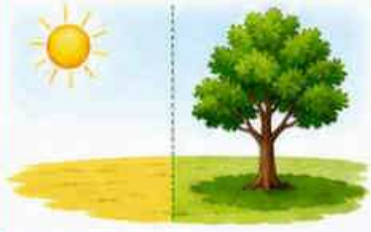
3. Concentrated sunlight

- A magnifying lens gathers sunlight into a small bright spot.
- A smaller spot becomes hotter.

4. Shadows

- A shadow forms when light is blocked.
- Shadow direction changes with the Sun's position.
- Shadow length is shortest when the Sun is highest.

5. Sun and shade



- Sunny ground becomes warmer.
- Shaded ground stays cooler and more moist.

KEY DEFINITIONS

- **light source:** An object that gives out its own light.
- **reflection:** The bouncing back of light from a surface.
- **shadow:** A dark area formed when light is blocked by an object.

QUICK COMPARISON

Regular reflection	Irregular reflection
Light reflects in the same direction.	Light reflects in many different directions.
Sunny place	**Shaded place**
More direct sunlight. Warmer and drier ground.	Less direct sunlight. Cooler and more moist ground.

USING A COMPASS WITH SHADOWS

- Place the compass flat on your hand.
- Wait until the needle stops moving.
- The red end points north.
- Knowing directions helps us record shadow direction more accurately.

KEY FACTS

- Light travels in straight lines.
- Mirrors change the direction of light by reflection.
- A shadow forms opposite the light source.
- More direct sunlight means higher ground temperature.

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Properties of Sound

Chapter 5 | Introduction

How are sounds produced, how loud do they become, and how do they travel to our ears?

CHAPTER OVERVIEW

- 5.1 How Is Sound Produced?
- 5.2 Loudness and Vibration
- 5.3 How Does Sound Travel?

KEY VOCABULARY

Sound:
vibrations we hear when they reach our ears.

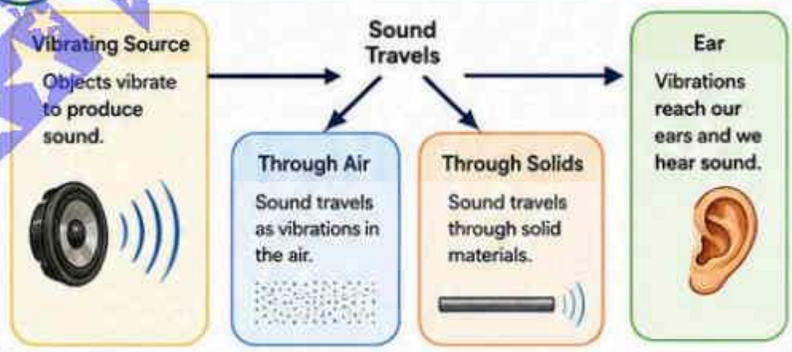
Amount of vibration:
how much an object moves back and forth.

Loudness:
how loud or quiet a sound is.

WHAT YOU WILL LEARN

- Sound is produced by vibrating objects.
- Greater vibration produces a louder sound.
- Sound travels through air.
- Sound can also travel through solids.

CHAPTER MAP



EVERYDAY EXAMPLES

Guitar String

The string vibrates and produces sound.

Voice (Throat)

Vocal cords vibrate to produce sound.

Bell

The bell vibrates and rings.

Cup-and-String Telephone

Sound travels through the string to the ear.

Science Field:
Physical Science

Topic:
Properties of Sound

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How Is Sound Produced?

Chapter 5 | Lesson 5.1

When a person plays an oud or a guitar, what happens to the strings while the instrument makes sound?

KEY CONCEPT

Sound is produced when objects vibrate.
If vibration stops, sound stops.

INVESTIGATION: Feel the Vibrations in Your Throat

1. Put two fingers gently on your throat.

2. Speak in a clear voice and feel what happens.

3. Stop speaking and notice the change.

OBSERVATION

While speaking, you can feel vibrations in your throat.
When you stop speaking, the vibrations stop.

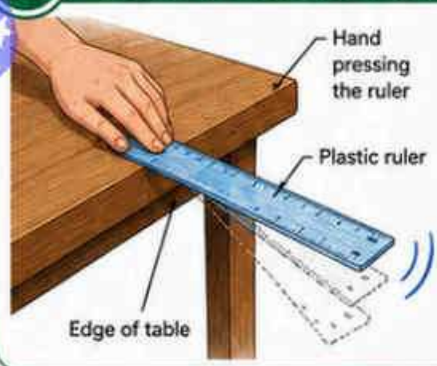
CONCLUSION

So, your voice is produced by vibrations.

IMPORTANT NOTE

Even if vibrations are too small to be seen, objects still vibrate when they produce sound.

TRY IT YOURSELF: Sound and Vibration



Procedure:
Press one end of the ruler, then release it and watch the moving end.

Observe and answer:

- When do you hear the sound?
- What happens to the sound when the ruler stops moving?
- What do you conclude?

Conclusion:
The ruler makes sound while it is vibrating.
When its motion stops, the sound stops.

REMEMBER

Vibration is the back-and-forth movement of an object.

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How Does Sound Travel Through Air?

Chapter 5 | Lesson 5.3

If sound is produced by vibrating objects, how does it move from the source to our ears?

HOW SOUND TRAVELS

Sound travels through air. When an object vibrates, it makes the air around it vibrate. These vibrations move through the air until they reach the ear, so we hear sound.

1 Sound Source (a vibrating object)

The object vibrates.

2 Medium / Surrounding Air

The surrounding air vibrates.

The vibrations move through the air.

3 Receiver / Ear

The vibrations reach the ear, so we hear the sound.

WHAT HAPPENS IF...?

Hit a triangle, then hold it firmly.

Conclusion:
The triangle vibrates and makes sound. When you hold it firmly, the vibration stops, so the sound stops at once.

WHY?

Why can you hear your teacher's voice even when your teacher is standing far away in the classroom?

Answer:
Because sound travels as vibrations through the air until it reaches your ears.

Sound: vibrations that travel through air until they reach the ear, so we hear them.

QUICK CHECK

Decide whether each statement is true or false.

1. Sound is produced when objects are completely still.
2. Sound travels in air as vibrations until it reaches our ears.
3. Sound moving through air is like vibrations passing from place to place.

Think carefully and decide which statements are correct.

CHALLENGE

What happens if you press your hand on a vibrating ruler that is making a loud sound?

Science Field: Physical Science

Topic: Sound in Air

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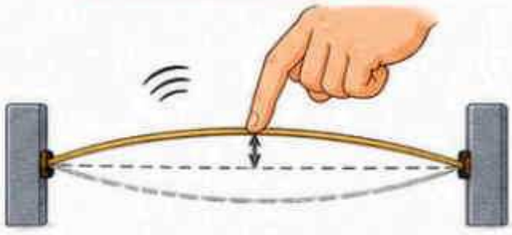
Loudness and Vibration

Chapter 5 | Lesson 5.2

If you tap on a door gently and then strongly, why do the sounds seem different?

Loudness is how loud or quiet a sound is.

Case 1: Gentle pluck



- The strip moves back and forth a short distance.
- The amount of vibration is small.
- The sound is quiet.

movement of the strip → amount of vibration → loudness

Case 2: Strong pluck

- The strip moves back and forth a greater distance.
- The amount of vibration is greater.
- The sound is louder.

Loudness depends on the amount of vibration of an object.
As the amount of vibration increases, the sound becomes louder.

Do not put your ears close to a very loud sound, because loud sounds may harm your hearing.

Try It Yourself: Vibration and Loudness

Procedure: Tap the container gently, then tap it more strongly. Watch the movement of the grains and listen to the sound.

Observe and answer:

- How did the movement of the grains differ in the two cases?
- In which case was the sound louder?
- What shows that the vibration was greater when the tap was stronger?

Conclusion: Greater movement of the grains shows greater vibration, and this produces a louder sound.

Science Field: Physical Science

Topic: Loudness

REMEMBER

- A bigger vibration produces a louder sound.

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Investigation: Vibration and Loudness

Chapter 5 | Practical Investigation

INVESTIGATION QUESTION / PREDICTION

How does the amount of vibration affect the loudness of a sound?

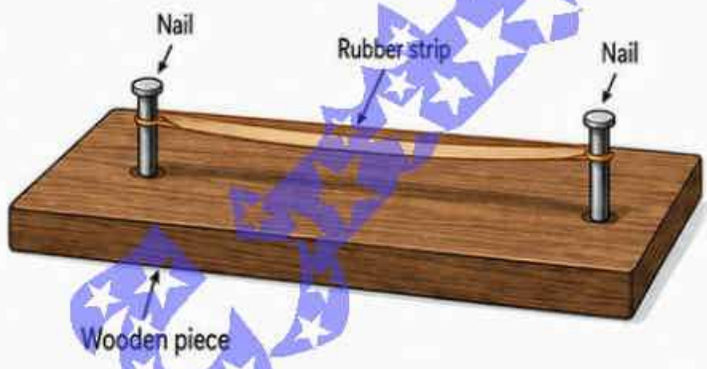
Predict the relationship between the amount of vibration of an object and the loudness of the sound it produces.

TOOLS

- a flexible rubber strip
- a wooden piece
- two nails

PROCEDURE

1. Fix the rubber strip between the two nails on the wooden piece so that the strip is stretched.
2. Pluck the rubber strip gently and watch how far it vibrates. Listen to the sound.
3. Pluck the rubber strip more strongly and notice the difference in the amount of vibration and the sound.
4. Record your observations and write your conclusion.



OBSERVATIONS / RESULTS

CASE 1: GENTLE PLUCK

The rubber strip vibrates a short distance and produces a quiet sound.

CASE 2: STRONG PLUCK

The rubber strip vibrates a greater distance and produces a louder sound.

ANALYSIS AND CONCLUSION

- The amount of vibration of the strip is greater when it is plucked more strongly.
- Loudness depends on the amount of vibration. As the amount of vibration increases, the sound becomes louder.

RECORD YOUR FINDINGS

- I noticed that...
- I conclude that...

Science Field: Physical Science

Topic: Amount of Vibration

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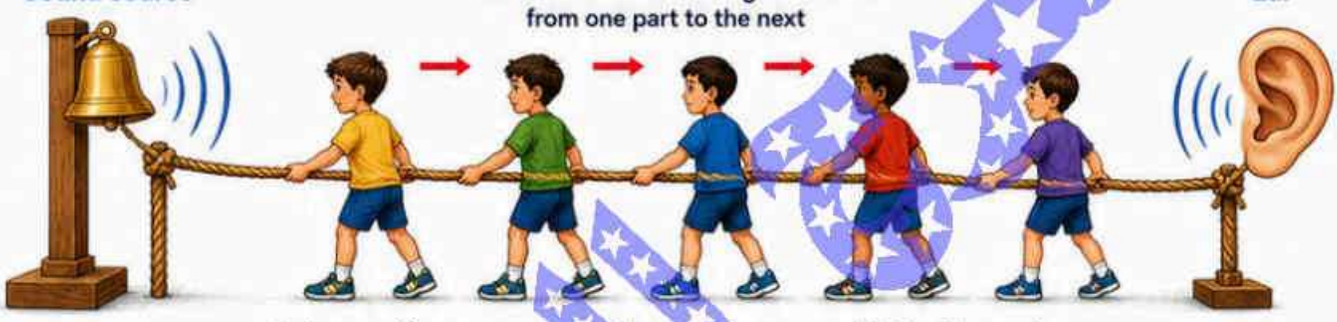
Sound Can Travel Through Solids

Chapter 5 | Lesson 5.3

If you put your ear on a wooden door while someone knocks on the other side, will you hear the sound?

WHAT'S HAPPENING?

- Sound does not travel only through air.
- Sound also travels through solids such as wood, string, and wire.
- When the source vibrates, the vibrations move through the solid from one part to the next until they reach the ear.



Just as motion passes along the rope from one child to the next, sound passes through the solid until it reaches the ear.

WHY?

Why can you hear the ticking of a clock more clearly when you put your ear on the wooden table on which the clock is placed?

- Because wood carries vibrations better than air, so the sound reaches the ear more clearly.

TRY IT YOURSELF: WHICH WAY IS FASTER?

Procedure:

- Put one ear on the table and close the other ear with your finger. Ask a classmate to scratch the far end of the table gently, then more strongly. Move your ear away from the table and compare what you hear.

Observe and answer:

1. In which case did you hear the sound more clearly?
2. What shows that wood transferred the vibrations to your ear?

Sound travels through solids as vibrations. The easier the vibrations move through the solid, the more clearly the sound is heard.

EXAMPLES: SOLIDS THAT CARRY SOUND

Wood

Wire

String

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Make a String Telephone

Chapter 5 | Practical Activity

Follow these steps to make a string telephone.

TOOLS AND MATERIALS

2 paper cups

Scissors

Adhesive tape

Coloured pencils

Hole-making tool (awl or thick pin)

1 Prepare the cups. Use coloured pencils to decorate the two paper cups.

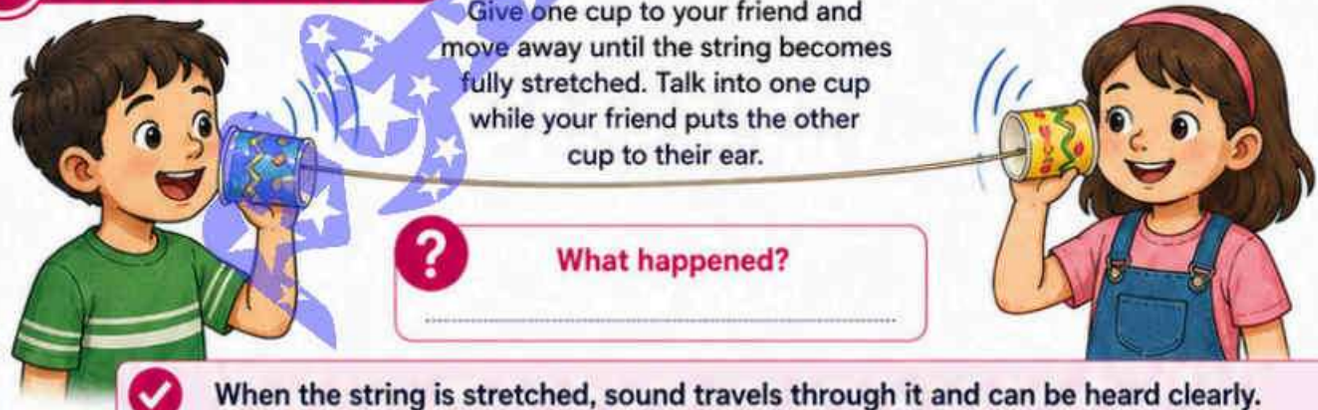
2 Make a small hole carefully in the centre of the bottom of each cup using a hole-making tool.

3 Pass the string through the hole in the bottom of each cup from the outside to the inside.

4 Tie the end of the string inside each cup using a knot or a small bead, or fix it with adhesive tape so that it does not slip out.

TRY IT AND ANALYSE

Give one cup to your friend and move away until the string becomes fully stretched. Talk into one cup while your friend puts the other cup to their ear.



What happened?

.....

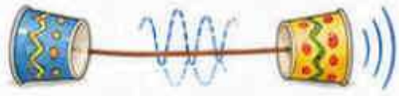
When the string is stretched, sound travels through it and can be heard clearly.

SAFETY AND CARE

Make the holes carefully and ask for help if needed.

HOW IT WORKS

Speaking makes the cup vibrate. The vibrations move through the stretched string to the other cup and then to the ear.



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Investigation: Sound Through a String

Chapter 5 | Practical Investigation

Can sound travel through solids such as string?

How does the condition of the string affect how clearly the sound is heard?

TOOLS

A string telephone

PROCEDURE

1. Ask your friend to speak into one cup while you listen with the other cup to your ear. Make sure the string is stretched.
2. Repeat the same step, but leave the string loose.
3. Hold the string firmly at the middle with your fingers, then ask your friend to speak into the stretched string telephone again.
4. Record your observations and write your conclusion.

OBSERVATIONS / RESULTS

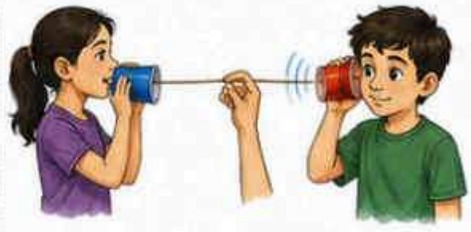
Case 1: Stretched string

The sound is heard clearly.

Case 2: Loose string

The sound is difficult to hear.

Case 3: Holding the string in the middle



The sound becomes weaker and may not be heard.

ANALYSIS AND CONCLUSION

- When the string is stretched, vibrations travel easily, so the sound is heard clearly.
- When the string is loose, or when it is held in the middle, the vibrations become weaker or stop moving through it.
- Sound travels through solids as vibrations. The more easily the vibrations travel, the more clearly the sound is heard.

RECORD YOUR FINDINGS

The clearest sound was in...

This happened because...

A stretched string carries sound better than a loose string.

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Light and Sound – Final Review

Chapters 4–5 | Review & Connection

HISTORY CONNECTION: LIGHT AND SOUND AT THE PYRAMIDS

At the pyramids in Egypt, a sound-and-light show tells a story from history using ideas about light and sound.

Light: Light travels in straight lines through air, so strong beams can be directed accurately. Colours appear when light is reflected from the stones.

Sound: Large stone surfaces can reflect sound, so voices and sounds can be heard clearly in open spaces.

LIGHT

1 Light travels in straight lines around us.

A light source is a body that gives out its own light.

Examples: the Sun, a lamp, a candle, a torch.

2 Reflection of light

Reflection is the bouncing back of light when it falls on a surface.

Type of reflection	Description	Examples
Regular reflection	light rays bounce in one organised direction from a smooth shiny surface	a mirror, aluminium foil
Irregular reflection	light rays scatter in different directions from a rough surface	wood, plastic

3 Magnifying glass

A magnifying glass gathers light from a large area into a small bright spot.

Result: the light becomes brighter and the temperature increases.

4 Shadows

A shadow is a dark area formed behind an object because light does not pass through the object.

The length and direction of the shadow change when the position of the light source changes. The shadow is shorter when the Sun is higher in the sky.

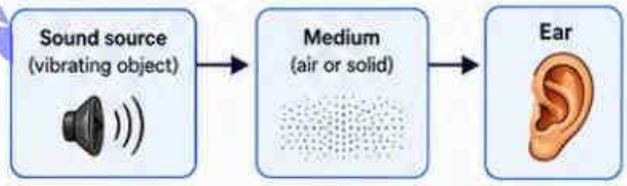
SOUND

1 Loudness of sound

Sound is vibrations that travel through air until they reach the ear, so we hear them.

Sound is produced by vibrating objects. When the vibration stops, the sound stops.

2 How sound travels



3 Sound travels through solids

Sound can travel through solid materials such as:

wood, wire, string.

4 Loudness and vibration

Loudness depends on the amount of vibration of the object. Greater vibration makes the sound louder.

When the string is stretched, sound is heard more clearly. When it is loose or held in the middle, the sound becomes weaker.

REMEMBER

Light and sound help us understand the world around us through observing, reflecting, vibrating, and travelling.

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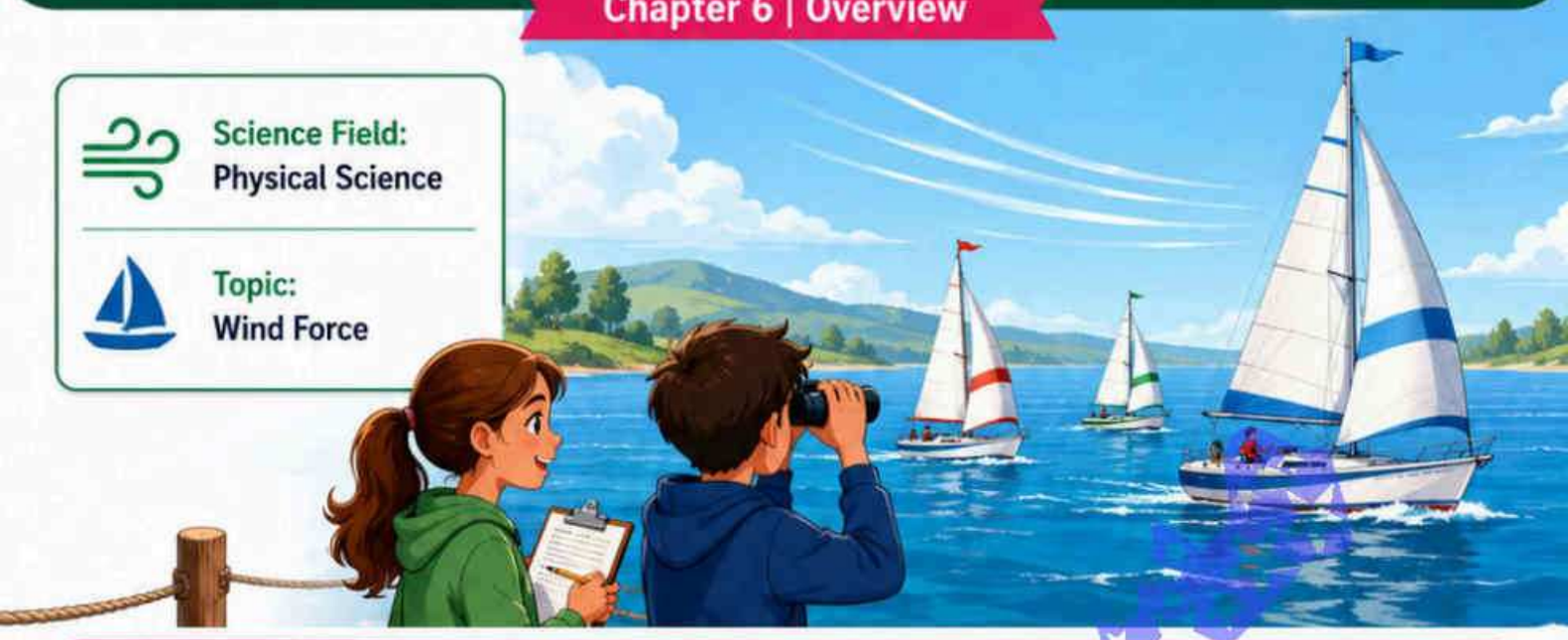
Wind Force

Chapter 6 | Overview

Science Field: Physical Science

Topic: Wind Force



MAIN ENQUIRY QUESTION

How do wind force and sail size affect the motion and distance travelled by an object?

WHAT YOU WILL LEARN

- Force can change the motion of an object.
- Stronger wind exerts a greater force.
- Greater force makes an object move farther.
- A larger sail catches more air and increases the distance travelled.

CHAPTER SECTIONS
PAGE MAP

1. Force Changes Motion
2. Wind Strength and Motion
3. Build a Wind-Powered Car
4. Testing Weak and Strong Wind
5. Why Sail Size Matters
6. Investigating Sail Size
7. Chapter Review

KEY CONCEPTS

Force
a push or a pull that can change the state of motion of an object.

Wind Force
the force exerted by moving air.

Surface Area
the area of an object exposed to the wind.

Motion
movement from one place to another.

BIG IDEA

As wind force increases, the effect on motion increases and the object can travel a longer distance.

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Force Changes Motion

Chapter 6 | Lesson Concept

Science Field: Physical Science

Topic: Force Changes Motion

THINK ABOUT IT

When wind blows, leaves move.
Which moves the leaves farther: weak wind or strong wind?

WHAT IS FORCE?

Force is a push or a pull that can change the state of motion of an object, whether it is at rest or moving.

HOW FORCE AFFECTS MOTION

1. A force can set a stationary object in motion.

2. A force can change the direction of a moving object.

3. A force can stop a moving object.

A force may start motion, change motion, or stop motion.

TRY IT YOURSELF

Place a light sheet of paper on a surface.
Blow on it gently, then blow on it more strongly.

Gentle blow

Strong blow

a What caused the paper to move in both cases?

.....

b What is the difference between the distance travelled after a gentle blow and after a strong blow?

.....

.....

REMEMBER

The greater the force, the greater its effect on the motion of an object.

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Wind Strength and Motion

Chapter 6 | Comparison

Science Field: Physical Science

Topic: Wind Strength and Motion

Wind exerts a force on objects and can make them move.

HOW WIND STRENGTH AFFECTS MOTION

WEAK WIND

- The force is smaller.
- The effect on motion is less.
- The object moves a shorter distance.

Stronger wind
↓
greater force
↓
greater effect on motion
↓
longer distance travelled.

STRONG WIND

- The force is greater.
- The effect on motion is greater.
- The object moves a longer distance.

The greater the force acting on an object, the longer the distance it can travel.

WHY?

Why do wind-powered objects move farther in strong wind than in weak wind?

→ Because strong wind exerts a greater force on the object.

MINI REVIEW

1. Force affects the _____ of objects.
2. When wind force increases, the distance travelled _____.

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Build a Wind-Powered Car

Chapter 6 | Activity

Science Field: Physical Science

Topic: Wind-Powered Car

AIM: To investigate how wind force affects the motion of objects.

PREDICTION / QUESTION

How does changing wind force affect the movement of a toy car with a sail?

TOOLS

plastic bottle caps

a wooden stick

an empty milk carton

adhesive tape

thick paper

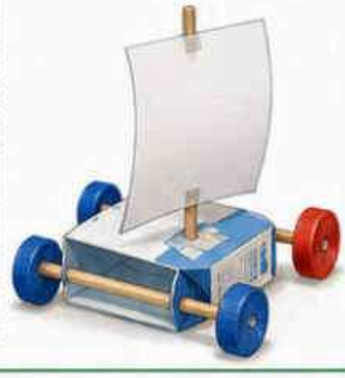
HOW TO BUILD THE CAR

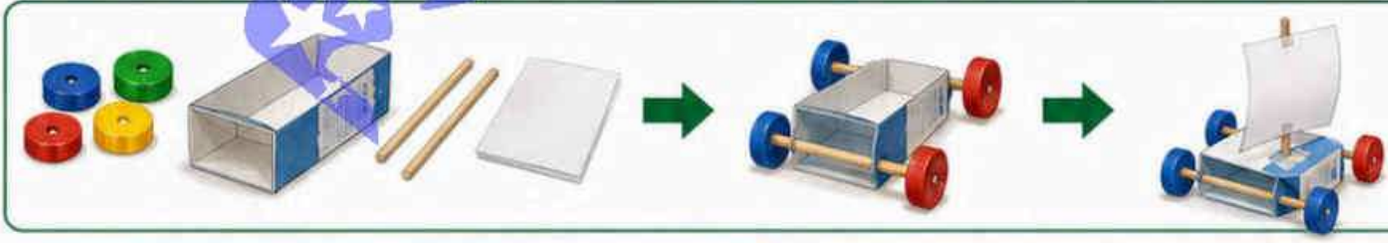
1. Use the empty milk carton as the body of the car.

2. Make the wheels from plastic bottle caps. Make a hole in the centre of each cap.

3. Pass wooden sticks through the carton and attach the bottle-cap wheels to make the axles.

4. Make a sail from thick paper and fix it to the car body with adhesive tape.





READY FOR TESTING

The finished car can be used to test how wind force changes the distance travelled.

IMPORTANT NOTE

Use the same car during the investigation so that only the wind force changes.

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Testing Weak and Strong Wind

Chapter 6 | Experiment

Science Field: Physical Science

Topic: Wind Force Investigation

AIM: To investigate how changing wind force affects the distance travelled by the wind-powered car.

FAIR TEST

Use the same car and the same starting point each time. Only change the speed of the fan.

A WEAK WIND

1. Place the car at the starting point.
2. Set the fan to a low speed.
3. Measure the distance travelled until the car stops.
4. Repeat the test three times and record the results.

Distance travelled (example): 109 cm

B STRONG WIND

1. Place the car at the same starting point.
2. Set the fan to a high speed.
3. Measure the distance travelled until the car stops.
4. Repeat the test three times and record the results.

Distance travelled (example): 324 cm

RESULTS AND OBSERVATIONS

TABLE 1: WEAK WIND

Attempt	Distance travelled (cm)
Attempt 1	117 cm
Attempt 2	196 cm
Attempt 3	178 cm

Observation: With weak wind, the car moved and travelled a short distance.

TABLE 2: STRONG WIND

Attempt	Distance travelled (cm)
Attempt 1	320 cm
Attempt 2	337 cm
Attempt 3	324 cm

Observation: With strong wind, the car moved and travelled a longer distance.

ANALYSIS AND CONCLUSION

Increasing the speed of the fan increased the force acting on the car. As a result, the car travelled a longer distance.

When the force acting on an object increases, the distance it travels increases.

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Why Sail Size Matters

Chapter 6 | Explanation

Science Field: Physical Science

Topic: Sail Size

THINK ABOUT IT

If two sailboats move in the same wind, but one sail is larger than the other, which boat will travel farther? Why?

Wind helps objects move, but the effect does not depend on **wind force** alone. It also depends on the **surface area** exposed to the wind.

THE EFFECT OF SAIL SIZE ON MOTION

SMALL SAIL

- Smaller surface area
- Catches less air
- The force acting on the boat is smaller
- Travels a shorter distance

- Larger sail area
- more air reaches the sail
- greater wind force on the boat
- longer distance travelled.

LARGE SAIL

- Larger surface area
- Catches more air
- The force acting on the boat is greater
- Travels a longer distance

When the **surface area** exposed to the wind increases, the **wind force** on the object increases. As a result, the **distance travelled** increases.

EXPLAIN

Q Why do some sailboats travel farther than others even in the same wind?

A Because the surface area of the sail exposed to the wind is different.

MINI REVIEW

1. The larger the sail area, the _____ amount of air it catches.
2. The distance travelled by a sailboat depends on wind force and the _____ exposed to the wind.

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Investigating Sail Size

Chapter 6 | Experiment

Science Field: Physical Science

Topic: Changing Sail Size

QUESTION

How does sail size affect the distance travelled by the car?

FAIR TEST RULE

To make the test fair, change only the sail size. Keep the fan speed, the starting point, and the car the same.

TOOLS

the wind-powered car

a fan

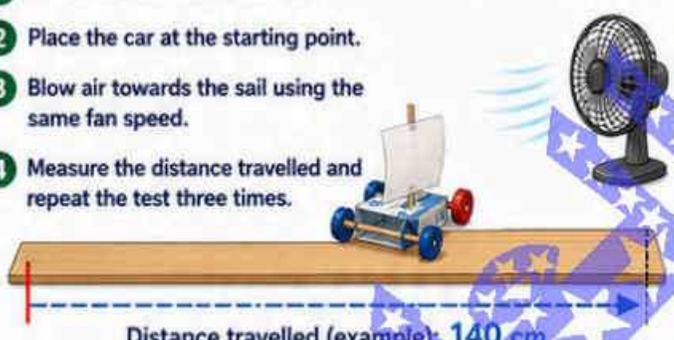
a small sail

a large sail

a measuring tape or ruler

TEST 1: SMALL SAIL

1. Attach a small sail to the car.
2. Place the car at the starting point.
3. Blow air towards the sail using the same fan speed.
4. Measure the distance travelled and repeat the test three times.



Distance travelled (example): 140 cm

TEST 2: LARGE SAIL

1. Replace the small sail with a large sail.
2. Place the car at the same starting point.
3. Blow air towards the sail using the same fan speed.
4. Measure the distance travelled and repeat the test three times.

Distance travelled (example): 324 cm

RESULTS AND OBSERVATIONS

TABLE 1: SMALL SAIL

Attempt	Distance travelled (cm)
Attempt 1	145 cm
Attempt 2	140 cm
Attempt 3	160 cm

Observation: With the small sail, the car moved and travelled a shorter distance.

TABLE 2: LARGE SAIL

Attempt	Distance travelled (cm)
Attempt 1	320 cm
Attempt 2	337 cm
Attempt 3	324 cm

Observation: With the large sail, the car moved and travelled a longer distance.

ANALYSIS AND CONCLUSION

Using the same fan speed and the same starting point, increasing the sail size increased the force of the wind on the car. Therefore, the car travelled a longer distance.

When the surface area exposed to the wind increases, the wind force increases and the distance travelled increases.

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Wind Force – Chapter Review

Chapter 6 | Review

Science Field: Physical Science

Topic: Chapter Review

KEY IDEAS

- Force changes the motion of objects.
- Wind exerts a force on objects.
- Stronger wind produces a greater force.
- Greater force causes a longer distance travelled.
- A larger surface area exposed to the wind catches more air.
- A larger sail increases the wind force on the object.

KEY CONCEPTS

Force – a push or a pull that can change the state of motion of an object.

Wind Force – the force exerted by moving air.

Surface Area – the area of an object exposed to the wind.

Motion – movement from one place to another.

WHAT THE EXPERIMENTS SHOW

1 Changing Wind Strength

Weak wind → shorter distance

Strong wind → longer distance

2 Changing Sail Size

Small sail → shorter distance

Large sail → longer distance

REMEMBER

- A force can start motion, change motion, or stop motion.
- When force increases, the distance travelled increases.
- When the surface area exposed to the wind increases, wind force increases.

EXPLAIN

Q Why does a large sail make an object travel farther?

A Because it catches more air and the wind force acting on it becomes greater.

CHAPTER SUMMARY

Wind can move objects because it exerts a force. The distance travelled depends on both the strength of the wind and the surface area exposed to it.

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RUBBER FORCE

From Stretching to Motion

BIG QUESTION

1. How can a stretched rubber band move an object?
2. What changes the distance the object travels?

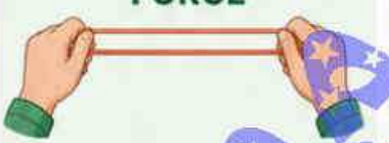
KEY CONCEPT

When a rubber band is stretched, it **stores energy**. When it returns to its original shape, it produces a **force** that can move objects.

WHAT WILL WE LEARN?

- Cars that work by rubber force.
- How changing the amount of stretch affects motion.
- How the number of rubber bands affects motion.
- Useful applications of rubber force and wind force.

FORCE



A stretched rubber band produces a force when it returns to its original shape.

MOTION

The force pushes the object and makes it move.

DISTANCE

Greater force makes the object move and travel farther.

IN THIS CHAPTER

7-1	Cars That Work by Rubber Force
7-2	Rubber Band Force
	Applications / Review

KEY IDEA

The greater the force, the greater the motion and the farther the object travels.

Prepared by **Mr. Mohamed Ibrahim**

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HOW DOES A RUBBER BAND MOVE AN OBJECT?

A rubber band can move an object because releasing a stretched rubber band produces a force.

1 NATURAL STATE

The rubber band is in its normal, relaxed shape.

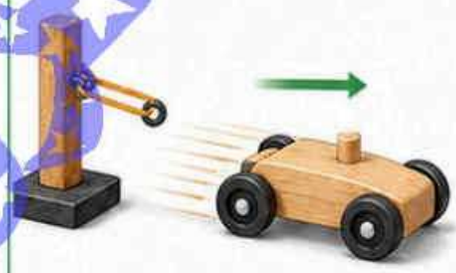
It does not push the car.

2 STRETCHING THE RUBBER BAND

When the rubber band is stretched, its shape changes and **energy is stored**.

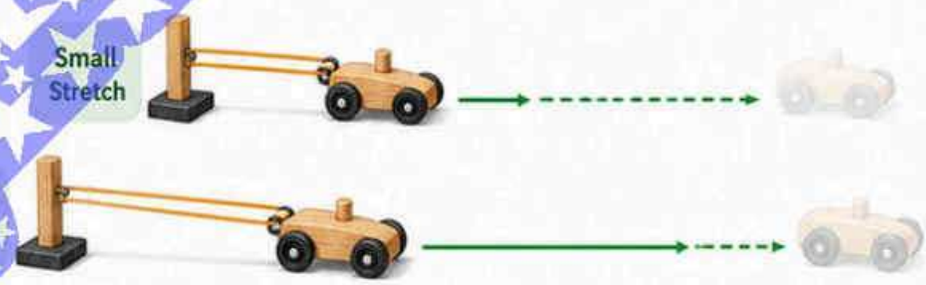
3 RELEASE AND PUSH

When the rubber band is released, it returns to its original shape and **pushes the car forward**.



THE EFFECT OF STRETCH AMOUNT

More stretch produces more force, so the car moves farther.



KEY IDEA

Releasing a stretched rubber band produces a force. The greater the stretch, the greater the force and the farther the object moves.

THINK AND ANSWER

Which makes the car travel farther: **a small stretch or a large stretch?**

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INVESTIGATION 1: DOES MORE STRETCH MAKE THE CAR TRAVEL FARTHER?

AIM

Investigate how changing the amount of stretch of a rubber band affects the distance travelled by a toy car.

TOOLS

Toy car

Hook or fixed stop board

Plastic launching surface or board

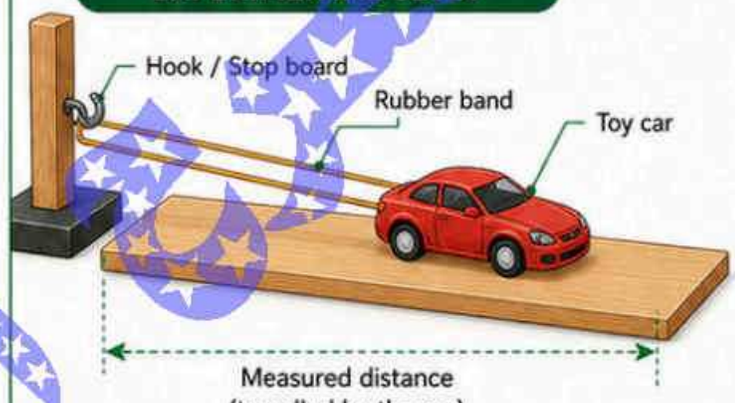
Rubber band

Measuring tape

PROCEDURE

1. Attach the rubber band securely to the back of the car.
2. Fix the other end of the rubber band to the hook or stop board.
3. Place the car on a smooth launching surface.
4. Stretch the rubber band to 5 cm, release the car, and measure the distance travelled.
5. Repeat with stretches of 10 cm and 15 cm.
6. Repeat each case three times and record the distances.

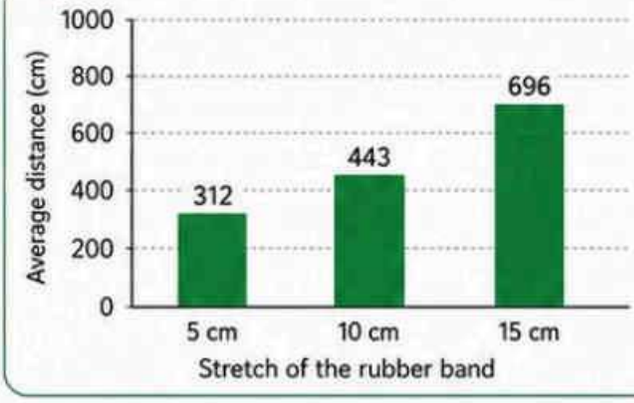
EXPERIMENTAL SETUP



RESULTS

Stretch of the rubber band (cm)	Distance travelled (cm)			Average distance (cm)
	Trial 1	Trial 2	Trial 3	
5	308	324	303	**312**
10	454	434	440	**443**
15	710	686	691	**696**

DISTANCE VS. STRETCH



OBSERVATIONS

- At 5 cm, the car travels a shorter distance.
- At 10 cm and 15 cm, the car moves with greater force and covers a longer distance.

CONCLUSION

Increasing the stretch of the rubber band increases the force it produces, so the toy car travels farther.

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MORE RUBBER BANDS, MORE FORCE

Changing the number of rubber bands affects the **force** on the object.

Increasing the amount of stretch is **not the only way** to increase force.

Using more than one rubber band increases the force because the forces of the bands **work together.**

1 MORE RUBBER BANDS

Using more rubber bands increases the pull on the car.

2 GREATER FORCE

More bands create a greater force on the car.

3 LONGER DISTANCE

A greater force makes the car move farther.

COMPARE AND SEE THE DIFFERENCE

ONE RUBBER BAND

- Smaller force on the car.
- The car travels a shorter distance.

TWO OR MORE RUBBER BANDS

- Greater force on the car.
- The car travels a longer distance.

KEY IDEA

The more rubber bands used, the greater the force on the object, and the farther it travels.

THINK AND ANSWER

- How does using more rubber bands change the force on the car and the distance it travels?

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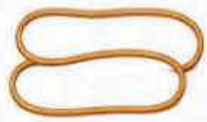
INVESTIGATION 2: ONE RUBBER BAND OR TWO?

AIM

Investigate how changing the number of rubber bands affects the distance travelled by the car while keeping the stretch distance the same.

TOOLS

Toy car (from the previous experiment)



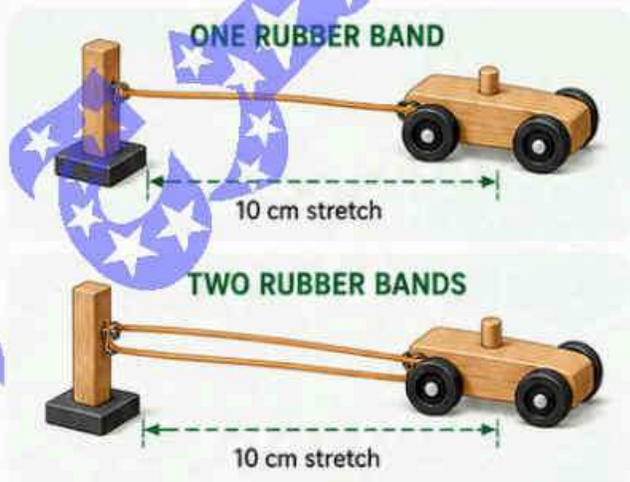
Two rubber bands

Measuring tape

Launching board or stop board

PROCEDURE

1. Attach one rubber band to the car and stretch it to 10 cm.
2. Release the car and measure the distance it travels.
3. Replace the single band with two rubber bands together and stretch them by the same 10 cm.
4. Release the car and measure the distance again.
5. Repeat both cases three times and record the results.



RESULTS

Number of rubber bands	Distance travelled (cm)		
	Trial 1	Trial 2	Trial 3
1 rubber band	454 cm	434 cm	440 cm
2 rubber bands	711 cm	695 cm	716 cm

OBSERVATIONS

- With one rubber band, the car moved with less force and travelled a shorter distance.
- With more than one rubber band, the car moved with greater force and travelled farther.

CONCLUSION

The more rubber bands used, the greater the force on the object, and the farther it travels.

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APPLICATIONS OF RUBBER FORCE AND WIND FORCE

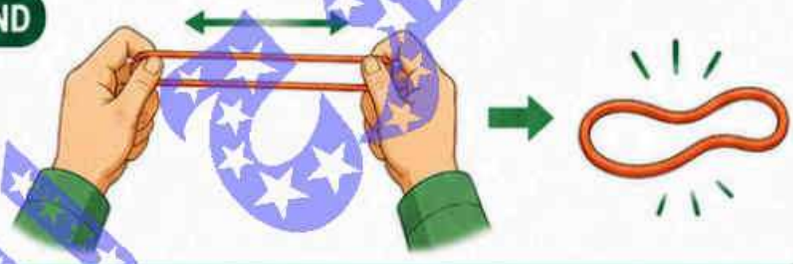
Forces are not only in our science lessons.
They help people in many useful ways in everyday life.

1 WIND FORCE AND SAILBOATS

- People developed smart ways to use wind force.
- A traditional sailboat on the Nile uses wind force.
- The sail catches the wind.
- By adjusting the sail, the sailor controls the direction of movement.

2 STORED ENERGY IN A RUBBER BAND

- When a rubber band is stretched, **stored energy** increases.
- When released, it returns to its original shape and produces a force.



3 ANCIENT BOW AND ARROW

- The bow **stores energy** when it is stretched.
- When released, it pushes the arrow forward.

4 WIND POWER PLANTS

- On the Red Sea coast in Egypt, there are giant wind turbines, making this project one of the **largest wind-farm projects** in the world.
- Wind turns the turbine blades and helps produce useful **electrical energy**.

KEY IDEA

People have used rubber force and wind force in many smart ways to make life easier and to produce useful energy.

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FORCE AND MOTION: FINAL REVIEW

Different forces can affect how objects move.
The greater the force, the greater its effect on motion and distance.

1 WIND FORCE

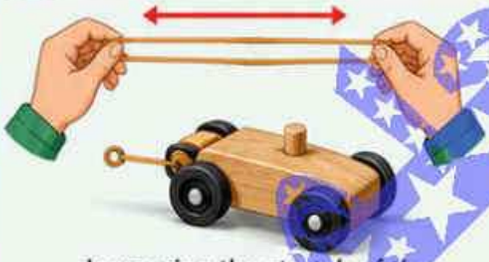
Moving air (wind) can push objects and affect their motion. The stronger the wind, the greater the force.

Greater Force → More Motion → Longer Distance

2 SAIL AREA

Increasing the sail area increases the force of the wind on the sail, so the sailboat travels farther.

3 AMOUNT OF STRETCH



Increasing the stretch of the rubber band increases the force it produces, so the car travels farther.

4 NUMBER OF RUBBER BANDS

Using more rubber bands increases the total force, so the car travels farther.

KEY SUMMARIES

- A force can start motion or change motion.
- The greater the force, the greater its effect on motion and distance.

BIG THINK

How can increasing force help a sailboat or a rubber band car travel farther?

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SOIL, WATER AND LIFE IN EGYPT

Chapter 8 Overview

In this chapter, we explore how soil and water are related in Egypt and how this knowledge helps us understand farming and how ancient Egyptians moved huge stone statues.

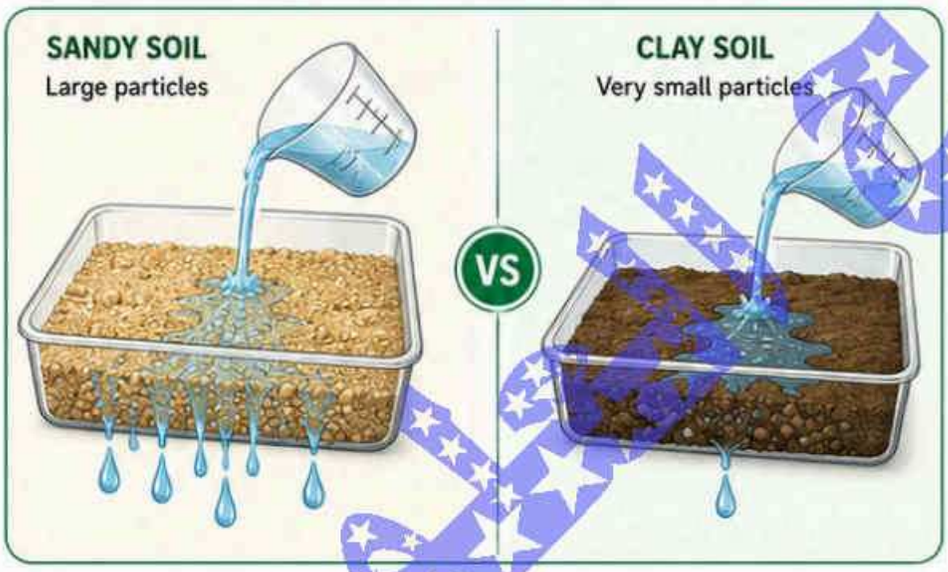
BIG QUESTION

1. How does water move differently through different types of soil?
2. How did ancient Egyptians move huge stone statues more easily?

IN THIS CHAPTER

8-1 The Relationship Between Land and Water

8-2 Moving Huge Stone Statues



FROM SOIL TO FARMING

MOVING HEAVY OBJECTS

KEY CONCEPTS

- Water moves through soil at different speeds.
- Soil particle size and the spaces between particles affect water movement and water retention.
- Clay soil keeps water longer than sandy soil.
- Wet sand can make moving heavy objects easier.
- Combining forces makes it easier to move heavy objects.

MAIN TERMS

- sandy soil
- clay soil
- water retention
- combine forces

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WHY DOES WATER MOVE DIFFERENTLY THROUGH SOIL?

BIG QUESTION

Why does water pass through some soils quickly and through others slowly?

IN THIS SECTION

1. Sandy soil has large particles and wide spaces, so water moves quickly.
2. Clay soil has very small particles and narrow spaces, so water moves slowly.
3. Soil particle size and the spaces between particles affect both water movement and water retention.

SANDY SOIL

Large particles and wide spaces

1. Large soil particles

Particles are large.

2. Wide spaces between particles

Spaces between particles are wide.

3. Water passes through quickly

Water moves through soil quickly.

Result: Sandy soil has fast water movement and low water retention.

CLAY SOIL

Very small particles and narrow spaces

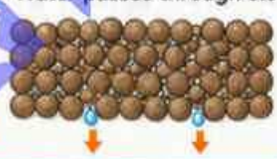
1. Very small soil particles

Particles are very small.

2. Narrow spaces between particles

Spaces between particles are narrow.

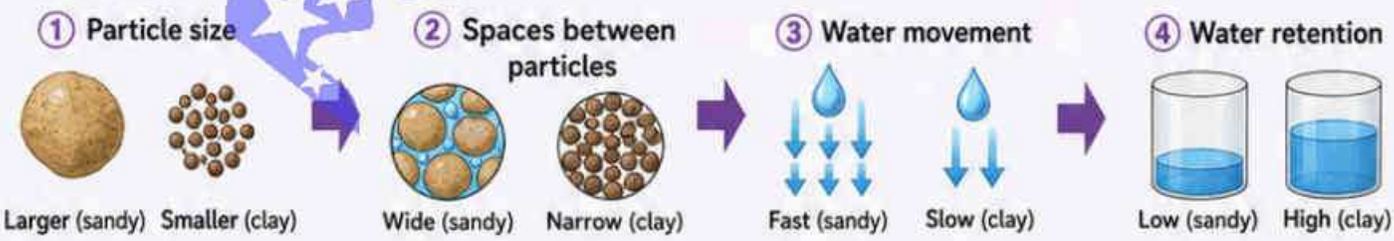
3. Water passes through slowly



Water moves through soil slowly.

Result: Clay soil has slow water movement and high water retention.

HOW PARTICLE SIZE AFFECTS WATER



KEY IDEA

Soil particle size and the spaces between particles control how fast water moves through soil and how much water the soil can hold.

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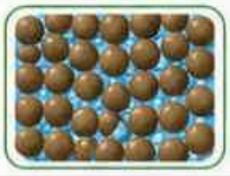
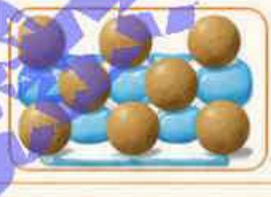
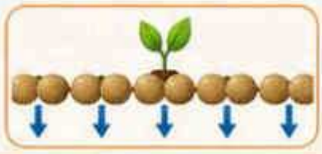
CLAY SOIL VS. SANDY SOIL

Land and water are closely connected. The type of soil affects how water moves, how long it stays, and how well crops can grow.

IN THIS CHAPTER

8-1 The Relationship Between Land and Water

	CLAY SOIL (NILE SILT)	SANDY SOIL (DESERT SAND)
PARTICLE SIZE	Very small particles.	Large particles.
SPACES BETWEEN PARTICLES	Narrow spaces between particles. 	Wide spaces between particles. 
SPEED OF WATER MOVEMENT	Water moves slowly.	Water moves quickly.
ABILITY TO KEEP WATER AND NUTRIENTS	Keeps water and nutrients for a longer time.	Does not keep water for a long time. 
FARMING SUITABILITY	Suitable for farming. Provides water and nutrients that plants need.	Not ideal for farming. Needs special means to help keep water and reduce loss.

HOW IS LAND FARMED IN EGYPT?

FARMING ON CLAY SOIL (NILE SILT)

- Water is kept for a longer time in the soil.
- Nutrients are available to plants.
- Suitable for growing many crops.
- Farming is easy and productive.

FARMING ON SANDY SOIL (DESERT SAND)

- Water moves quickly and is lost easily.
- Special means are needed to keep water, such as drip irrigation.
- Add organic matter and use windbreaks to reduce loss.
- Careful management is required.

KEY TAKEAWAY

Clay soil has very **small** particles and **narrow** spaces, so water moves **slowly** and is kept for a **longer** time, making it **suitable** for farming.
Sandy soil has **large** particles and **wide** spaces, so water moves **quickly** and is **lost**, so **special methods** are needed to keep it.

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INVESTIGATION: WHICH SOIL HOLDS WATER LONGER?

AIM

To investigate which soil—sandy soil or clay soil—holds water longer.

TOOLS

2 cut plastic bottles (or simple filters)

Sandy soil and clay soil

2 measuring cups (same amount)

2 collecting cups (same size)

Gauze or cloth and rubber bands

2 holders (stands)

Stopwatch (or timer)

QUESTION OR PREDICTION

- **Question:** Which soil will let more water pass through in the same time?
- **Prediction:** _____

_____

PROCEDURE

1. **Prepare the two setups.**
   Cut two plastic bottles (top part only). Place a piece of gauze or cloth over the neck of each bottle and secure it with a rubber band. Put each bottle in a holder above a collecting cup.
2. **Add soil.**
   Put the same amount of sandy soil in the left bottle. Put the same amount of clay soil in the right bottle.
3. **Add water at the same time.**
   Pour the same amount of water into both bottles at exactly the same time.
4. **Observe and compare.**
   Use the stopwatch to record what happens. Which setup lets water pass first? Which cup collects more water in the same time?

OBSERVATIONS

During the same time:

SANDY SOIL

- More water passes through quickly.
- The cup collects more water.

During the same time:

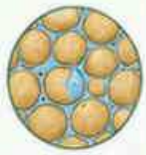
CLAY SOIL

- Less water passes through.
- The cup collects less water.

ANALYSIS

Why does sandy soil let more water pass?

- Sandy soil has larger particles.
- The spaces between particles are wider.
- Water moves through easily and quickly.



Why does clay soil let less water pass?

- Clay soil has very small particles.
- The spaces between particles are narrow.
- Water moves through slowly and less water passes.

CONCLUSION

Sandy soil lets water pass quickly because:

- Its particles are larger.
- The spaces between particles are wider.

Clay soil lets water pass slowly because:

- Its particles are small.
- The spaces between particles are narrow.

KEY IDEA

Soil particle size and the spaces between particles control how fast water moves through soil. Sandy soil holds water for a shorter time, while clay soil holds water longer.

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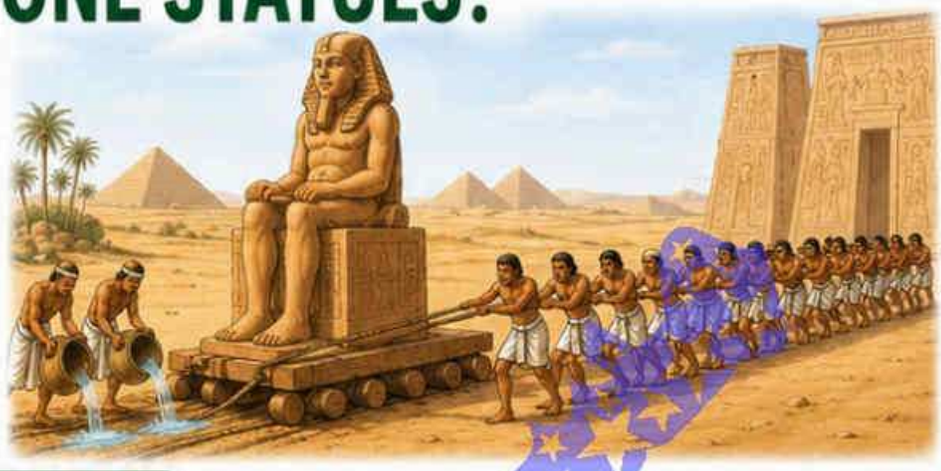
HOW DID ANCIENT EGYPTIANS MOVE HUGE STONE STATUES?

THE PROBLEM

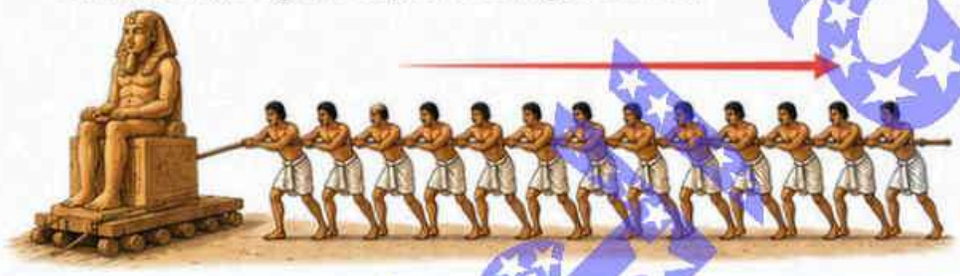
A huge stone statue is extremely heavy.
Moving it needs a very large force.



TWO SMART IDEAS USED BY ANCIENT EGYPTIANS

1 COMBINING FORCES

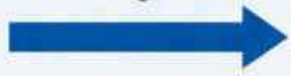
Many people pull the statue in the same direction.
Their forces add together to produce a large total force.



HOW IT WORKS

Many small pulls

One large force



2 MAKING THE SURFACE MORE SLIPPERY

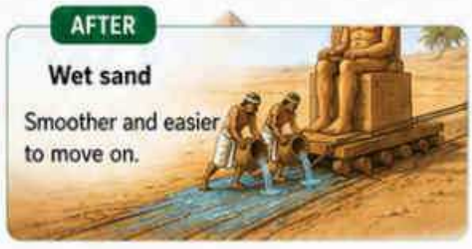
Water is poured on the sand in front of the sledge.
The wet sand becomes more slippery, so the force needed to move the statue becomes less.

BEFORE

Dry sand
Rough and harder to move on.

AFTER

Wet sand
Smoother and easier to move on.



HOW IT WORKS

Water makes the sand smoother.
Less rubbing (friction) means a smaller force is needed to move the statue.

KEY EXPLANATION

- **Combining forces:** When many people pull together in the same direction, their forces add up and create a large total force that can move a very heavy object.
- **Making the surface more slippery:** Water reduces friction between the sledge and the sand, so the statue moves more easily with less force.

THINK ABOUT IT!

Why does wet sand help ancient Egyptians move huge stone statues more easily?

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INVESTIGATION: DOES WET SAND MAKE PULLING EASIER?

Chapter 8 Practical Activity

QUESTION

Does wet sand help us pull a heavy object more easily?

TOOLS

- Tray with dry sand
- Small heavy toy (e.g., toy car)
- Smooth plastic lid or plate
- String
- Cup with a little water

PROCEDURE

1. Place the small heavy toy on the smooth plastic lid (acting like a sled).
2. Tie the string firmly to the front of the lid.
3. Put the lid with the toy on dry sand in the tray.
4. Pull the string slowly and observe how it moves.
5. Sprinkle a little water on the sand path in front of the lid.
6. Pull the string again and observe how it moves.

OBSERVATIONS

DRY SAND

- The sand piles up in front of the lid.
- It blocks movement. Pulling is hard and the lid moves only a little.

VS

WET SAND

- The wet sand becomes smoother and flatter.
- The lid moves more easily and slides further without sinking.

CONCLUSION

When a suitable small amount of water is sprayed on the sand, the sand becomes more slippery. The resistance decreases, so pulling the heavy object becomes easier.

LINK TO ANCIENT EGYPTIANS

Ancient Egyptians likely sprinkled water on the sand in front of the sleds to make the path smoother and pull huge stone statues more easily.

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FROM SOIL TO FARMING IN EGYPT

Egypt has two main kinds of soil. The Nile gives us fertile clay soil in the valley and delta, while our deserts have sandy soil. The way soil holds and moves water affects how we farm and the methods we use.

REMEMBER

Water movement depends on the size of soil particles and the spaces between them.

Small particles small spaces → slow movement

Large particles large spaces → fast movement

HOW DIFFERENT SOILS WORK IN FARMING

CLAY SOIL (NILE SILT)

Clay soil comes from fine silt carried by the Nile. It is found in the valley and delta where most of Egypt's crops are grown.

Water moves through it slowly.
The tiny spaces between the particles slow down water.

Keeps water and nutrients for a longer period.
This helps plants get the water and food they need.

Suitable for farming.
It supports many crops such as wheat, rice, vegetables, and fruits.

✓ Clay soil is fertile and keeps water well, so it is ideal for growing crops.

SANDY SOIL (DESERT SAND)

Sandy soil comes from desert sand. It has large particles and big spaces between them.

Water moves through it quickly.
The large spaces let water pass through very fast.

Does not keep water for a long period.
Water drains down or evaporates quickly, so plants can dry out.

Farming needs special means.
We use methods that help keep water and reduce its loss.

To farm in sandy soil, we must use smart methods to keep water and save it.

SMART WAYS TO FARM IN SANDY SOIL

Drip irrigation gives water slowly and directly to the roots.

Mulching covers the soil to reduce evaporation and keep moisture.

Windbreaks (trees or fences) reduce wind and water loss.

Adding organic matter (compost, manure) helps the soil hold water better.

THINK AND ANSWER

1. Why does clay soil in the Nile valley help farmers grow many crops?

2. What special methods can farmers use to grow crops in sandy soil?

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SOIL, WATER AND HEAVY OBJECTS: FINAL REVIEW

Review the key ideas from Chapter 8 and see how soil, water and force work together in nature and in ancient Egyptian achievements.

1 THE RELATIONSHIP BETWEEN LAND AND WATER

Soil type affects how water moves and how much it is kept.

SOIL PARTICLE SIZE & SPACES

CLAY SOIL (Nile silt)
Very small particles

- Very small grains.
- Very small spaces between particles.

SANDY SOIL (desert sand)
Large particles

- Large grains.
- Large spaces between particles.

WATER MOVEMENT (Through Soil)

CLAY SOIL
Water moves slowly.

VS

SANDY SOIL
Water moves quickly.

WATER RETENTION (Kept by Soil)

CLAY SOIL
Keeps water longer.

VS

SANDY SOIL
Does not keep water long.

Clay soil (Nile silt) has small particles and small spaces. Water moves slowly and is kept for a long time.
Sandy soil (desert sand) has large particles and large spaces. Water moves quickly and is not kept for long.

2 MOVING HUGE STONE STATUES

Ancient Egyptians moved very heavy statues by combining forces and using wet sand.

COMBINING FORCES

Many people pulling together + Wet sand → Easier movement of heavy objects

More force and better surface conditions make heavy objects easier to move.

WETTING SAND MAKES MOVEMENT EASIER

Water changes sand so it can support and help objects move.

DRY SAND (LOOSE)
- Grains are far apart.
- Water drains through quickly.
- Does not keep water.
- Hard to move objects.

WET SAND (DAMP)
- Grains are closer together.
- Water stays between grains.
- Sand becomes firm and supportive.
- Easier to move objects.

TOO WET (SATURATED)
- Too much water.
- Grains float or lose contact.
- Cannot support objects.
- Movement becomes difficult.

BIG IDEA

Soil type controls how water moves and how much is kept.

More force or better surface conditions change motion and make heavy objects easier to move.

REMEMBER!

- Clay soil has tiny particles and small spaces. Water moves slowly and is kept longer.
- Sandy soil has large particles and big spaces. Water moves quickly and is not kept long.
- Ancient Egyptians combined many people's forces and used wet sand to move huge stone statues.
- Changing surface conditions or increasing force makes heavy objects easier to move.

CONCEPT MAP

Soil Type → Particle Size → Spaces Between Particles → Water Movement (Speed) / Water Retention (Kept or Not)

Forces (Many People) → Surface Condition (Wet Sand) → Easier Movement of Heavy Objects

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